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SOCIETY FOR BRITISH ENTOMOLOGY

VOL. 2

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F. J. KILLINGTON, B.Sc., A.L.S., F.R.E.S.

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B. M. HOBBY, M.A., D.PHIL., F.R.E.S.

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TRANSACTIONS OF THE SOCIETY FOR BRITISH ENTOMOLOGY

VOL. 2. 8th JULY, 1935. PART 1.

A KEY TO THE MEMBERS OF THE FAMILY BRUCHIDAE (COL.) OF ECONOMIC IMPORTANCE IN EUROPE.

By GWYNETH M. HERFORD, B.Sc.

(From the Royal College of Science, London, and the Institut für angewandte Entomologie, Munich.)

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FOREWORD.

The following key deals with those members of the family Bruchidae which have been shown from time to time to have economic importance in European countries and to be of actual or likely occurrence in Great Britain. The New World Bruchidae are, therefore, for the most part excluded, except for such species as *Callosobruchus maculatus* (Fabr.) and *Bruchidius pruininus* (Horn), whose economic position in their own country is such as to make their periodic importation into Europe almost inevitable. The selection of species has been based chiefly on the *Review of Applied Entomology* (from which identifications of species have had for the most part to be taken at their face value); also on a recent paper by Dr. J. C. Bridwell and L. J. Bottimer (1933) on *Bruchus brachialis* Fåhr. and allied species; and on species sent from time to time from different trade sources.

The greater part of the work has been done on the material in the British Museum (Natural History), South Kensington, with the kind permission of Dr. K. G. Blair, to whom I am much indebted. The Old World species *Callosobruchus analis* (Fabr.) has been considered by Dr. Blair to be identical with the New

World species *C. maculatus* (Fabr.) and is here treated under that name. In the same way the Spanish bean-beetle, usually known as *Bruchus affinis* Fröl. (which name belongs to a distinct and at present non-economic species) was found in preliminary work to be indistinguishable from *B. rufimanus* (Boh.), of which it is probably a geographical race.

The descriptions in the key are intended only as a supplement to the key itself, and make no attempt, therefore, to be exhaustive, The genus *Bruchus,* which contains about half the species here considered, has certain features which are less specifically constant than others; these are notably the pubescence, colour of tarsi, and frontal keel, which have been used by many previous authors with injudicious freedom. The colouring of the legs is not always constant, and only those parts have been used here which have not shown variation in the series examined or figured in Schilsky's (1905) list of variations. The average colour is given in the descriptions.

The elytra and prothorax are each viewed from above their middle point; the elytra are assumed to be completely closed. The legs of the insect are rotated to stand out at right angles to the body, the femoro-tibial joint being anterior. The parts are named accordingly.

My sincere thanks are due to the authorities of the Deutsches Museum in Munich for permission to use the collection of Bruchidae therein; to the authorities of the Zoologisches Museum, Berlin, of the Deutsches Entomologisches Institut, Berlin-Dahlem, and of the Zoologisches Museum, Hamburg, for series of *B. brachialis* Fåhr. obtained for me through the valuable assistance of Dr. W. Zwölfer, of the Institut für angewandte Entomologie, Munich. I should like, further, to express my great obligation to Mr. G. Fox-Wilson, of Wisley, for his continued help, particularly in the checking and extending of the list of food-plants; to Miss J. Stephens, whose help in utilisation of the excellent resources of the library of the Royal Entomological Society so greatly assisted the tedious work of verification of all original references; and to Dr. O. W. Richards for most useful advice and for the original suggestion of the construction of this key.

Key to Sub-families.

1. Mesopleural suture obscure, joining mesometapleural suture near its middle, leaving the mesepimeron remote from the coxal cavity (Pl. I, Fig. 1A). Tibiae without movable spurs. Hind tarsus about as long as tibia. Hind femur about as wide as coxa. Eyes strongly emarginate
..... **Bruchinae** (p. 3).

— Mesopleural suture distinct, free from mesometapleural suture, so that the mesepimeron sends a clearly visible extension to the coxal cavity (Pl. I, Fig. 1B). Hind tibia with two movable spurs, *or* hind femur very broad, serrate beneath ..... 2.

2. Hind femur not broad, only half as wide as hind coxa, longitudinally bicarinate beneath, the outer carina larger, without any tooth (Pl. I, Fig. 2). Hind tibia straight, bicalcarate, not mucronate. Hind tarsus as long as tibia. Pronotum without impressed line above the lateral carina. Eyes fairly strongly emarginate ... **Amblycerinae** (p. 19).

— Hind femur very broad, much wider than coxa, unicarinate beneath, with a serrate ridge. Hind tibia strongly arched, with trowel-shaped mucro at the apex. Hind tarsus much shorter than the tibia. Pronotum with a distinct impressed line continued from the basal margin above the lateral carina (Pl. I, Fig. 3). Eyes may be hardly emarginate ..... **Pachymerinae** (p. 20).

SUB-FAMILY BRUCHINAE.

Key to Genera.

1. Prothorax conical; its sides from posterior angles to cervical foramen straight or slightly undulating (Pl. I, Fig. 4). Hind femur bicarinate, with conspicuous tooth on *each* carina ..... **Callosobruchus** Pic (p. 4).

— Sides of prothorax convex, sometimes strongly rounded at humerus (Pl. I, Fig. 6). Hind femur feebly bicarinate, with not more than one carina bearing a tooth ..... 2.

2. Lateral margin of prothorax with a tooth near the middle (Pl. II, Fig. 12) followed usually by an emargination. Side of prothorax rounded anteriorly to the tooth, straight or somewhat concave behind, prothorax subquadrangular. Hind femur bearing on *outer* keel a strong tooth, apical to which is a deep depression (Pl. I, Fig. 5). Hind legs always black ..... **Bruchus** Linn. (p. 7).

— Prothorax without lateral tooth. Hind femur simple or sinuate on lower outer margin, bearing tooth or teeth only on inner carina ..... 3.

3. Prothorax more or less conically contracted in front. Hind femur bearing on the inner carina a single more or less obvious tooth, without small teeth apical to it. No noticeable teeth on front of middle tibiae. Hind tibia bearing tooth on anterior side of apex, also sometimes on posterior side ..... **Bruchidius** Schil. (p. 15).

— Hind femur bearing on inner carina a large, sharp tooth followed by two or three small, sharp teeth (Pl. I, Fig. 7). Intermediate sternites usually somewhat abbreviated. 3—4·5 mm. ..... **Acanthoscelides** Schil.

1. GENUS *ACANTHOSCELIDES* Schilsky, 1905.

Acanthoscelides obtectus (Say).

1831. *Bruchus obtectus* Say, Descr. N. Amer. Curcul. : 1.

Prothorax conical, upper surface smoothly convex, slightly depressed before posterior margin, median lobe hardly raised. Sides convex, especially in anterior half. Posterior angles about ninety degrees (Pl. I, Fig. 6). Lateral margin obsolete anteriorly. Punctuation very fine, mixed with macro-punctures separated by about their own diameter. Elytra together about one-sixth longer than broad, rather flattened dorsally, humeral callosities inconspicuous, punctuation rather small, almost uniform. Antennae reaching slightly beyond base of prothorax, noticeably broader from fifth segment; segments broader than long, subserrate. Hind femur feebly bicarinate beneath, inner carina bearing conspicuous tooth, apical to which are two small sharp denticles (Pl. I, Fig. 7). Hind tibia with short sharp posterior tooth. Pygidium as in *B. ervi,* subvertical and noticeably convex in the male. Surface colour of prothorax and elytra, head, segments 6-10 of antennae, thoracic sternites, ventral half of hind and sometimes of middle femur, central parts of abdominal sternites, black; pygidium, remainder of legs, segments 1-5 and 11 of antennae rufous. Pubescence greyish-yellow, uniform on prothorax (without light patch on median lobe) and on scutellum, and variegated with darker brown spots on elytra. Pubescence on pygidium fawn-colour, fine and uniform; under parts similar, the covering slightly thicker on outer edge on metasternites and on row of dots down lateral margin of abdomen.

2. GENUS *CALLOSOBRUCHUS* Pic, 1902.

Key to Species.

1. Prothorax with sides slightly convex. Hind tibia with definite anterior tooth (Pl. II, Fig. 13B). Pygidium subvertical to oblique, easily visible beyond the elytra, very generally marked with two large black spots, divided by a narrow white line. Antennae not pectinate in the male. 3—4·5 mm. ..... **maculatus** (Fabr.).

— Prothorax with sides straight or concave. Hind tibia without definite anterior tooth (Pl. II, Fig. 13A). Pygidium vertical to subvertical, hardly visible beyond the elytra;

black spots obscure, or reduced to small black dots at the outer edge of the pygidium. Antennae pectinate in the male ..... 2.

2. Pygidium distinctly pointed, longer than broad, generally vertical. Elytra together form a square. Prothorax with sides practically straight (Pl. I, Fig. 4). 2·5—3·5 mm. ..... **chinensis** (Linn.).

— Pygidium not distinctly pointed with well-rounded sides (Pl. II, Fig. 11A) and generally slightly visible beyond the elytra, which form together a short rectangle. Prothorax with sides undulating and partly concave. 3—4 mm. ..... **phaseoli** (Chevrol.).

Descriptions of Species.

Callosobruchus maculatus (Fabr.).

1775. *Bruchus maculatus* Fabricius, Ent. Syst. : 65.

Prothorax conical, with sides slightly convex in the middle, and lateral margin obscure. Posterior angles less than right angles. Median lobe not usually much raised, often clothed, like the scutellum, with white pubescence. Elytra together form a short rectangle. Humeral callosities fairly pronounced. Antennae reaching about half-way down the elytra, subserrate. Frons usually slightly keeled. Hind tibia with distinct anterior tooth, in addition to strong posterior one (Pl. II, Fig. 13B). Hind femur as in *C. chinensis*. Pygidium somewhat pointed, but with strongly convex sides, oblique and projecting beyond elytra. Surface colouring very variable. Elytra usually rufous, with dark transverse band at middle and often also at anterior and posterior ends, the middle and posterior patches forming four dark spots (Pl. II, Fig. 9). Prothorax usually rufous, head usually dark. Antennae rufous to dark, legs rufous. Hind coxae, thoracic and abdominal sternites usually deep rufous. Pubescence on elytra and most of prothorax straw-coloured and whitish; pygidium with whitish pubescence around two large black areas that usually cover most of its surface. Thoracic and abdominal sternites with whitish pubescence, especially at outer corners of mes- and metepimera.

Callosobruchus chinensis (Linn.).

1758. *Curculio chinensis* Linnaeus, Syst. Nat., ed. 10 : 386.

Prothorax conical, with almost straight sides and obscure lateral margin. Posterior angles approximately rectangular. Median lobe with two pronounced longitudinal callosities (Pl. I, Fig. 4) separated by a groove, and thickly covered with white

pubescence. Scutellum also white. Elytra together forming a square (Pl. II, Fig. 8), humeral callosities pronounced. Abdominal sternites much abbreviated. Antennae reaching quite half-way down elytra, subserrate in the female, pectinate in the male, with regular increase in size from second segment onwards. Frons slightly keeled. Hind tibia with strong posterior tooth and no conspicuous anterior tooth (Pl. II, Fig. 13A). Hind femur with ventral channel, bounded by inner and outer ridge, *each* bearing a tooth. Pygidium long and somewhat pointed (Pl. II, Fig 11B), usually vertical, seldom projecting beyond the elytra. Surface colouring very variable. Elytra usually rufous, with short dark transverse band at middle of margin (Pl. II, Fig. 8). Prothorax and head rufous to dark. Antennae rufous, darker towards apex. Legs rufous. Hind coxae and thoracic sternites usually dark. Pygidium rufous, generally with two small, dark, longitudinal patches widely separated. Pubescence usually variegated straw-colour on elytra and most of prothorax; white and rather thick on pygidium, sutures of meso- and metasternites and outer part of abdominal sternites.

Callosobruchus phaseoli (Chevrol.).

1833. *Bruchus phaseoli* Chevrolat, in Schoenherr, Gen. et Sp. Curc., **1** (1): 37–8.

Prothorax conical, sides undulating and partly concave; a depression above posterior angles. Median lobe slightly raised, covered with whitish hair. A dark chestnut streak usually runs forward from this. Elytra together nearly forming a square. Humeral callosities moderately pronounced. Abdominal sternites usually abbreviated. Antennae reaching half-way down elytra, subpectinate in the male. Frons usually slightly keeled, no conspicuous teeth on front and middle tibiae. Hind tibia with strong posterior and minute anterior teeth. Hind femur as in *C. chinensis* (*q.v.*). Pygidium with well-rounded sides, slightly longer than broad, subvertical. Last abdominal sternite distinctly the broadest, the rest being abbreviated. Surface colouring rather variable. Elytra rufous with characteristic dark semicircular patch on outer margin, often extending nearly to either end, and containing central light marks (Pl. II, Fig. 10). The remaining light areas may also be shaded. Prothorax and head deep rufous. Antennae with first four and terminal segment rufous, the rest usually darker. Legs rufous, thoracic and abdominal sternites rufous; hind coxae deep rufous. Pygidium rufous, with paired dark marks very faint or absent. Pubescence rather thick, over whole body; a dullish cream-colour, brown over the dark markings, uniform cream-colour on pygidium and under-surface; thicker towards outer side of sternites.

3. GENUS *BRUCHUS* Linn., 1767.

Key to Species.

1. Lateral tooth of prothorax placed before the middle of the lateral margin, long and sharp, followed by deep excavation (Pl. II, Fig. 15). 4·0—4·5 mm. ... **emarginatus** Allard.

— Lateral tooth at middle of lateral margin ..... 2.

2. Sides of prothorax behind lateral tooth parallel to subparallel; posterior angles approximately rectangular. Prothorax about twice as broad as long (Pl. II, Fig. 14). 3·0—3·5 mm. ..... 3.

— Sides of prothorax diverging behind lateral tooth; less than twice as broad as long. Posterior angles less than right angles (Pl. II, Fig. 12). 5 mm. ..... 9.

3. Elytra tapering (Pl. III, Fig. 19). Pygidium without paired dark patches. 3·0—3·5 mm. ..... **tristiculus** Fåhr.

— Elytra broadly rounded at the apex (Pl. III, Fig. 20). Pygidium nearly always with transverse pair of darker patches sometimes faint ..... 4.

4. Apex of antennae rufous ..... 5.

— Apex of antennae black ..... 6.

5. Middle tarsi and at least apex of middle tibiae rufous. Elytra with oblique white band in posterior half as in *B. ervi* (Pl. III, Fig. 20), but less distinct. 3·0—3·5 mm. ..... **signaticornis** Schoenh.

— Middle tibiae and tarsi black. No oblique white band. 3·0—3·5 mm. ..... **brachialis** Fåhr.

6. Middle femora wholly black ..... 7.

— Middle femora rufous at apex ..... 8.

7. Male with truncated lamella at apex of middle tibiae (Pl. III, Fig. 22). Sides of prothorax diverging slightly (Pl. II, Fig. 14). 3·0—3·5 mm. ..... **ulicis** Muls.

— Male with small, blunt tooth below apex of middle tibiae on inner side. Sides of prothorax quite parallel. 3·0—3·5 mm. ..... **lentis** Froelich.

8. Each elytron bearing a distinct oblique white stripe in the posterior half (Pl. III, Fig. 20). Male with a very small tooth at apex of middle tibia. 3·0—3·5 mm. ... **ervi** Froelich.

— Elytra without distinct oblique white stripe. Middle tibiae in the male with an apical lamella, bearing two dark spines at its external corners (Pl. III, Fig. 21). 3·0—3·5 mm. ..... **nubilus** Boh.

9. Front femora almost, usually entirely, black. Pygidium with two clearly defined oval black spots on ashy ground. Posterior angles and lateral teeth of prothorax sharply pointed. No conspicuous tooth on hind tibiae. 4·5—5·0 mm. ..... **pisorum** (L.).

— Front femora black only at base. Hind tibiae with strong tooth ..... 10.

10. Length 3·0—3·5 mm. Lateral tooth of prothorax small (Pl. II, Fig. 12). Middle tibia in the male with sharp tooth on the inside below the apex (Pl. III, Fig. 23). Pubescence in sparse grey dots and patches ..... **atomarius** (L.).

— Length 4·0—5·0 mm. Lateral tooth of prothorax strong . 11.

11. Large round black spot at posterior end of each elytron, bordered in front by narrow white semicircle. Pygidium as in *B. pisorum* (*q.v.*). Middle tibia in male with strong internal tooth, below apex ..... **dentipes** (Baudi).

— No large clear black spot. Elytra covered fairly uniformly with dull brown pubescence, with light and dark shading. Spots on pygidium usually faint. In the male a small apical tooth on middle tibia ..... **rufimanus** Boh.

Descriptions of Species.

Bruchus emarginatus Allard.

1868. *Bruchus emarginatus* Allard, *Ann. Soc. Ent. Belg.*, **11** : 104–105.

Prothorax very broadly transverse, subrectangular, the sides diverging from behind the lateral tooth, slightly convex. Lateral tooth situated before the middle, acute, with a pronounced posterior excavation (Pl. II, Fig. 15). Posterior angles pointed, lateral margin acute, obsolete in front; posterior margin very slightly bisinuate; upper surface strongly convex, especially in the middle. Punctuation mixed coarse and fine, the macro-punctures separated by their own width. Elytra together about one-quarter longer than broad, subparallel, with well-marked humeral callosities, covered with micro-punctures, usually confluent, and sparse macro-punctures. Antennae reaching the posterior margin of prothorax, segments 5 or 6 to 10 broader than long. Middle tibia in male very slightly curved, and bearing a small, dark, terminal spine. Hind femur bearing sharp tooth,

followed by U-shaped excavation, the arms of the U being of almost equal length (Pl. I, Fig. 13). Hind tibia with two small teeth in place of the more usual large, posterior tooth. Pygidium with rounded sides, surface convex, especially towards apex, oblique. Surface colour of head, body, elytra, segments 5—10 of antennae (usually), middle femur and all hind leg, black. Segments 1—4 and 11 of antennae (sometimes almost the whole), fore legs (excluding coxa), most or all of middle tibia and tarsus, rufous. Pubescence on under side sparse and dull grey, thicker on meso- and metasternites, and in patches on metapleurites and lateral margin of each abdominal segment. On upper surface of prothorax light brown, with a white triangle on the median lobe. Scutellum greyish; pubescence on elytra as in *B. pisorum* (*q.v.*), but greyer; pubescence on pygidium white, with two conspicuous black spots in the apical half, reaching the margin.

Bruchus tristiculus Fåhr.

1839. *Bruchus tristiculus* Fåhraeus, in Schoenherr, Gen. et Sp. Curc., **5** (1): 81–2.

Prothorax twice as broad as long, the lateral tooth very small, the sides behind it slightly convex, converging to the posterior angles, which are usually a little obtuse. Sides before lateral tooth evenly curved, not very prominent. Macro-punctures usually divided by less than their own width, mingled with minute micro-punctures. Elytra together about one-fifth longer than broad, somewhat convex (Pl. III, Fig. 19), humeral callosities hardly prominent, elytra tapering slightly at posterior end, usually showing, when closed, the upper lateral margins of three abdominal segments before the pygidium. Small, sparse macro-punctures in interstriae mixed with abundant, confluent micro-punctures. Antennae as in *B. ervi*. Middle tibia in male with two spines, one below the apex, strong and horizontal, the other apical, somewhat truncated, the space between them hollowed out and set with hairs. Hind femur with strong and acute tooth, hind tibia without conspicuously larger tooth on posterior ridge. Pygidium rather pointed, with very slightly convex sides, the surface convex in the posterior half. Body as a whole somewhat elongated. Surface colouring as in *B. ervi*, but at least the base of front femur and all the middle leg black. Pubescence short, clearly showing the surface colour; beneath as in *B. ervi*, but sparse and dull grey. Pubescence on prothorax dull brown, sparse, with small white triangle on median lobe; scutellum whitish; pubescence on elytra dull brown, with very obscure scattered greyish spots. Pubescence on pygidium almost uniform dark olive-grey, without paired dark marks.

Bruchus signaticornis Schoenh.

1833. *Bruchus signaticornis* Schoenherr, Gen. et Sp. Curc., **1** (1): 64.

Prothorax subrectangular, about twice as broad as long, chief convexity of humerus nearer to anterior foramen than to lateral tooth; the latter is small and sharp. Upper surface moderately convex, lateral margin distinct nearly to anterior face. Posterior angles usually rectangular. Punctuation of prothorax mixed, the macro-punctures scattered thickly and unevenly. Elytra together about one-quarter longer than broad, humeral callosities prominent laterally. Punctuation of elytra fine, often confluent, with a very few macro-punctures at the anterior end. Antennae as in *B. ervi* in the female, segments 5—10 broadly transverse in the male. No modifications of front tibia in the female, but in the male nearly as broad as the femur, flattened and with outer edge convex (Pl. III, Fig. 16A). Middle tibia bearing, before the apex, an inwardly projecting lamella, its plane at right angles to axis of tibia (Pl. III, Fig. 17); apical to this is a long slender spine. Hind femur with strong, acute tooth in the male, as in *B. pisorum* (*cf.* Pl. I, Fig. 5). Hind femur with two short teeth on posterior side, in place of usual single large tooth. Pygidium as in *B. ervi*. Surface colour as in *B. ervi,* save that in the male the whole fore leg, except for the coxa, the apices of at least the middle femur and tibia, middle tarsi and whole of antennae are rufous, the latter often darkened in the middle segments. In the female the base of front femur and segments 5—10 of antennae are black. Terminal segment rufous. Pubescence as in *B. ervi* beneath; upper surface of prothorax light brown, with whitish spots towards lateral margin, and white triangle over median lobe. Scutellum whitish. Pubescence on elytra brown, with dark patches and scattered light spots, the latter forming an oblique band in the hinder half of elytron. Posterior ends of elytra black. Pygidium whitish, with paired dark spots, widely separated.

Bruchus brachialis Fåhr.

1839. *Bruchus brachialis* Fåhraeus, in Schoenherr, Gen. et Sp. Curc., **5** (1): 79.

Prothorax twice as broad as long, sides most convex midway between anterior foramen and lateral tooth. The latter fairly small, acute; sides behind it parallel or very slightly divergent, posterior angles rectangular. Lateral margin very distinct, continued nearly to the anterior edge. Punctuation of prothorax coarse and thick, macro-punctures separated by less than their own width, micro-punctures relatively few. Elytra together one-quarter longer than broad; humeral callosities not project-

ing dorsally, and but slightly laterally. Punctuations of elytra fine, confluent, with a few macro-punctures in anterior half. Antennae as in *B. ervi* in the female, segments 5—10 broadly transverse in the male. Fore tibia in the male flattened and expanded, not so wide as femur (see *B. signaticornis,* Pl. III, Fig. 16A) and the edges approximately parallel (Pl. III, Fig. 16B). Middle tibia in the male somewhat curved, with terminal truncated lamella on inner side, nearly in plane of axis of tibia (Pl. III, Fig. 18), tooth on hind femur smaller than in *B. pisorum* (*cf.* Pl. 1, Fig. 5). Hind tibia without pronounced posterior apical tooth. Pygidium as in *B. ervi.* Surface colour as in *B. ervi,* save that in the male the antennae are entirely rufous, occasionally dusky in the middle segments. In the female, segments 1—4 or 5, and 11 are rufous. Fore legs in the male rufous, coxa and trochanter black. Base of femur black in female. Middle legs black. Pubescence below as in *B. ervi.* On upper surface of prothorax irregularly mottled light and darker brown. On elytra sparse and brown, with irregular flecks of white, not forming an oblique band. Scutellum and triangle on median lobe whitish. Pubescence on pygidium greyish, the two dark marks usually cloudy and indistinct.

Bruchus ulicis Muls.

1858. *Bruchus ulicis* Mulsant, Opusc. Ent., **8** : 33–6, 1 fig.

Prothorax as in *B. ervi,* but slightly diverging behind the small, sharp lateral tooth. Posterior angles less than right angles. Upper surface moderately convex. Elytra together one-quarter longer than broad, otherwise as in *B. ervi.* Middle tibia in the male with narrow blade at apex, bearing two terminal spinules. Hind tibia with small, sharp posterior tooth. Hind femur with smaller tooth than *B. pisorum* (*cf.* Pl. I, Fig. 5). Pygidium as in *B. ervi.* Surface colouring as in *B. ervi,* save that middle legs are usually wholly black. Pubescence below as in *B. ervi,* above fairly uniformly tawny on prothorax, save for whitish patch on median lobe; elytra mottled light and dark brown, the colouring being variable. Pygidium ashy, usually with two brown areas distinctly divided and hardly reaching the outer margin.

Bruchus nubilus Boh.

1833. *Bruchus nubilus* Boheman, in Schoenherr, Gen. et Sp. Curc., **1** (1) : 60.

Prothorax as in *B. ervi,* the sides behind the well-defined blunt lateral teeth sometimes slightly diverging, the posterior angles being then less than right angles. Elytra as in *B. ervi*; punctuation of prothorax and elytra also as in *B. ervi.* Antennae as in *B. ervi.* Middle tibia in male with sharp internal tooth

immediately below terminal tooth (Pl. III, Fig. 21). Hind femur with smaller tooth than in *B. pisorum* (*cf.* Pl. I, Fig. 5). Hind tibia with small sharp posterior tooth. Pygidium as in *B. ervi.* Surface colouring as in *B. ervi,* except that base of front femur, half of middle femur, and all hind legs are black. Pubescence sparse, dull brown, variegated with small ashy dots and patches; scutellum and patch on median lobe whitish; below as in *B. ervi.* Pygidium ashy, with the paired brown marks, if defined, clearly separated.

Bruchus ervi Froelich.

1799. *Bruchus ervi* Froelich, *Naturforscher,* **28**: 56–7.

Prothorax about twice as long as broad, subrectangular, strongly rounded before lateral tooth, sides parallel or slightly convergent behind it. Lateral tooth small, usually blunt. The median lobe projects but slightly beyond the posterior margin, and is not raised; posterior angles rectangular. Punctuation mixed; macro-punctures round, divided by their own width, with minute micro-punctures in the interstices. Elytra together one-fifth longer than broad, the outline regular, save for slight humeral callosities. Macro-punctures almost absent, micro-punctures confluent. Antennae reach hinder edge of prothorax, the first segment much longer than the second, after which the segments lengthen regularly, from the fifth or sixth. No conspicuous teeth on middle tibia in female; middle tibia in the male with a small black spine at the apex. Hind femur with smaller tooth than in *B. pisorum*; hind tibia with two small posterior teeth in place of the more usual single conspicuous tooth. Pygidium with rounded edges, slightly convex surface, oblique. Surface colour of body, head, elytra, segments 5 or 6 to 11 of antennae, base of middle femur and all hind legs black. Front legs and remainder of middle legs, and remaining segments of antennae, rufous. Pubescence on prothorax and elytra a rather uniform tawny-brown; scutellum, patch on median lobe, a mark near middle of second interstria, and oblique band running from fourth to eighth interstria in posterior half of elytron white (Pl. III, Fig. 20). The band is clear and distinct. Under surface with sparse whitish pubescence, thicker on lateral suture-lines of meso- and metathorax, and in row of white dots, one at lateral margin of each visible abdominal sternite. Upper part of pygidium and very narrow margin whitish, the apical section dusky, with usually a narrow white central line.

Bruchus lentis Froelich.

1799. *Bruchus lentis* Froelich, *Naturforscher,* **28**: 57–8.

Prothorax broadly transverse, subrectangular, sides parallel behind small lateral tooth. Posterior angles usually right angles.

Punctuation and antennae as in *B. ervi.* Elytra together one-quarter longer than broad, otherwise as in *B. ervi.* Middle tibia in male with small terminal tooth, and a second internal tooth immediately behind it. Hind femur with smaller tooth than in *B. pisorum* (*cf.* P. I, Fig. 5). Hind tibia without pronounced posterior tooth. Pygidium as in *B. ervi.* Surface colour as in *B. ervi,* save that base or whole of front femur, whole of middle femur and whole of hind leg are black. Pubescence on under surface as in *B. ervi*; on upper surface of prothorax rather sparse, tawny, with whitish patch on median lobe and often whitish corners. Scutellum whitish. Pubescence on elytra mottled light and dark brown irregularly. Pygidium ashy, usually showing two dark brown areas distinctly divided and hardly reaching the outer margin.

Bruchus pisorum (Linn.).

1758. *Dermestes pisorum* Linnaeus, Syst. Nat., ed. 10 : 356.

Prothorax subrectangular, a little more than one and a half times as broad as long, the sides behind the sharp conspicuous lateral tooth excavated, diverging to the acute posterior angles. Median lobe slightly raised. Elytra together about one and a quarter times as long as broad, humeral callosities slight. Macro-punctures abundant in anterior half. Antennae as in *B. ervi.* Middle tibia in male with small terminal tooth. Hind femur bearing strong acute tooth (Pl. I, Fig. 5), hind tibia with very small acute posterior tooth. Pygidium as in *B. ervi.* Surface colouring as in *B. ervi,* save that the front femur is wholly black (save sometimes at the extreme tip); middle and hind legs wholly black. Pubescence beneath as in *B. ervi.* Upper surface of prothorax with rich tawny and dark brown pubescence; white pubescent patch on median lobe. Scutellum white. Elytra with clearly-defined marks of tawny, dark brown, and white pubescence, including an irregular white transverse band in the posterior half. Pygidium white, with distinct black paired marks reaching the outer edge.

Bruchus atomarius (Linn.).

1761. *Curculio atomarius* Linnaeus, Faun. Suec., ed. 2 : 183.

Prothorax about one and a half times as broad as long, diverging behind the inconspicuous lateral tooth (usually hidden in hair) to the slightly acute posterior angles (Pl. II, Fig. 12). Elytra together about one-fifth longer than broad, shaped as in *B. ervi*; their punctuation small and even, macro-punctures almost absent. Antennae as in *B. ervi.* Middle tibia in the male with sharp terminal tooth and conspicuous bladed internal tooth behind it (Pl. III, Fig. 23); tibia somewhat curved. Hind femur

with rather small, usually right-angled tooth. Hind tibia with small sharp posterior tooth. Pygidium as in *B. ervi.* Colouring as in *B. ervi,* save that base of front femur, all middle and all hind legs are black. Pubescence beneath as in *B. ervi*; on elytra scanty, chiefly small irregular white dots mingled with brown. Scutellum, patch on median lobe, and characteristic patch behind scutellum, whitish. Four white dots may form a square on the prothorax, and another four a similar square on the elytra. This is not constant, however. Lateral teeth and posterior angles tipped with white. Pygidium usually uniformly dull grey, sometimes with clear dark paired marks.

Bruchus dentipes (Baudi).

1886. *Mylabris dentipes* Baudi, *Deuts. Ent. Z.,* **30** (2): 405.

Prothorax subrectangular, about one and a half times as broad as long; the sides behind the sharp, conspicuous lateral tooth excavated, and diverging to the acute posterior angles. Median lobe slightly raised. Elytra together about one and a quarter times as long as broad, humeral callosities not pronounced; macro-punctures numerous in anterior half. Antennae as in *B. ervi.* Middle tibia in male somewhat widened and hollowed, with apical tooth and second strong internal tooth below it. Tooth on hind femur usually acute, but less pronounced than in *B. pisorum* (*cf.* Pl. I, Fig. 5). Hind tibia with strong apical tooth. Pygidium as in *B. ervi.* Surface colouring as in *B. ervi,* save that bases of front femora and all middle and hind legs are black. Pubescence beneath as in *B. ervi*; on upper surface of prothorax rather sparse, tawny, with white patch on median lobe, and usually white corners. Scutellum whitish. Pubescence on elytra also sparse, whitish and tawny, the dots and patches usually arranged so as to give an irregular triangle, and leaving at the posterior ends two large oval black patches. Pygidium ashy, with distinct pair of black spots, clearly separated and reaching the outer edge.

Bruchus rufimanus Boh.

1833. *Bruchus rufimanus* Boheman, in Schoenherr, Gen. et Sp. Curc., **1** (1): 58–9.

Prothorax subrectangular, about one and a half times as broad as long; the sides behind the sharp, moderately prominent lateral teeth excavated, and diverging to the acute posterior angles. Median lobe slightly raised. Elytra as in *B. dentipes,* with abundant macro-punctures. Antennae as in *B. ervi.* Middle tibia in the male somewhat curved, 3-ridged, terminated on the inner side by a short, broad, inflected tooth. Hind femur with somewhat acute tooth, less pronounced than in *B. pisorum* (*cf.*

Pl. I, Fig. 5). Hind tibia with long posterior tooth. Pygidium as in *B. ervi.* Surface colouring as in *B. ervi,* save that base of front femur, all middle and all hind legs are black. Pubescence beneath as in *B. ervi*; on upper surface of prothorax tawny and dark brown, with whitish patch on median lobe; scutellum whitish. Elytra covered with dots and patches of white, tawny and dark brown pubescence, the markings cloudy and indefinite, the posterior dark areas with at least a sparse grey pubescence. Pygidium typically ashy grey; paired dark marks may, however, be conspicuous, and are then clearly divided and reach the outer margin.

4. GENUS *BRUCHIDIUS* Schilsky, 1903.

Key to Species.

1. Less than 1·75 mm. in length ..... **pusillimus** (Sharp).
— More than 2 mm. in length ..... 2.

2. Entirely black, except for bases of antennae, all tibiae and apices of femora, which are sometimes sooty brown. Outer carina of hind femur feeble. Inner with strong tooth, apical to which are usually two minute denticles. 2·5—3·5 mm. ..... **pruininus** (Horn).
— Partly or entirely brown ..... 3.

3. Only the eyes black; remainder medium to darker rufous. No pale patch on median lobe of prothorax. 2·5—3·0 mm. ..... **bixae** (Gyll.).
— Partly black. Median lobe commonly bears a thick light pubescent patch ..... 4.

4. Pygidium bright chestnut. Elytra as in Pl. III, Fig. 24. Median lobe of prothorax with conspicuous white patch, flanked by longitudinal ridges (Pl. III, Fig. 24). Posterior tooth on hind tibia not conspicuously the largest ..... **dorsalis** (Fåhr.).
— Pygidium wholly or partly black. White patch obscure *or* not flanked by ridges. Posterior tibial tooth much the largest ..... 5.

5. Antennal segments 5—11 broader than long. Terminal segment oval (Pl. IV, Fig. 28A). Sharp callus at anterior end of striae 3, 4 and 5. 3·5—4·5 mm. ..... **baudoni** (Caillol).
— Antennal segments 5—11 longer than broad. Terminal segment pointed and irregular (Pl. IV, Fig. 28B). No callus at anterior end of these striae. 2·5—3·5 mm. ..... **incarnatus** (Boh.).

Descriptions of Species.

Bruchidius incarnatus (Boh.).

1833. *Bruchus incarnatus* Boheman, in Schoenherr, Gen. et Sp. Curc., **1** (1): 72.

Prothorax at base about one and three-quarter times as broad as long, base bisinuate, sides convex, especially immediately before the middle; surface regularly convex, with mixed micro- and macro-punctures, median lobe not callose. Lateral margin rudimentary, posterior angles not quite right angles (Pl. III, Fig. 26). Elytra as in *B. lentis* (*q.v.*) much more finely punctured than prothorax. Antennae reaching slightly beyond prothorax, segments longer than broad (Pl. IV, Fig. 28B). Hind femur with two low ventral ridges, the inner bearing a pointed tooth near its apex. Hind tibia with a conspicuous posterior tooth and anterior point. Pygidium as in *B. ervi,* strongly convex at its apex. Surface colouring very variable. Head, prothorax, under surface, pygidium, base of hind femur often black. Antennae, remaining parts of legs, dark rufous. Elytra rufous, with black humeral region extending down the lateral margins. Pubescence beneath, uniform cream-colour, thicker on metasternites. On prothorax shaded light and dark brown, with a pale patch on median lobe, continuing narrowly forward in the middle. Elytra variably shaded with light and darker brown abundant pubescence. Pygidium with short greyish pubescence, and paired, longitudinal dark marks, well divided when distinct.

Bruchidius bixae (Gyll.).

1833. *Bruchus bixae* Gyllenhal, in Schoenherr, Gen. et Sp. Curc., **1** (1): 32.

Prothorax as in Pl. IV, Fig. 27, short and sturdy, with very broad anterior end and slightly convex sides, the surface smoothly convex, and covered with rather small uniform punctures. Posterior angles blunt, not quite right angled. Elytra as in *B. ervi,* covered with small punctures. Antennae not reaching beyond base of prothorax. Segments 5—10 broader than long. Hind femur with two ventral ridges, the inner bearing near the apex a long tooth. Hind tibia about four times as long as broad, with conspicuous posterior tooth, longitudinal ridges and strong anterior point. Pygidium about as broad as long, the upper half flattened. Surface colouring all rufous, except for the black eyes; the elytra bear obscure darker spots, and the ventral sutures are darker. Pubescence beneath rather sparse, whitish, thicker on sutures and clearly defining the mesepimeron. Pubescence also sparse above, white and golden, in small patches on elytra; scutellum white, prothorax mostly golden, leaving a characteristic broad, dark, central longitudinal stripe (Pl. IV,

Fig. 27) and no white patch on the median lobe. Pubescence on pygidium pale and thin, except for white transverse upper quarter, which may break up into three white pubescent spots.

Bruchidius dorsalis (Fåhr.).

1839. *Bruchus dorsalis* Fåhraeus, in Schoenherr, Gen. et Sp. Curc., **5** (1) : 98.

Prothorax conical, rather less than one and a half times as broad as long; sides concave posteriorly, convex anteriorly. Surface undulating, median lobe with pronounced longitudinal callosities, the posterior angles flattened dorso-ventrally. Lateral margins obsolete anteriorly, posterior angles rather less than right angles. Elytra as in Pl. III, Fig. 24, with distinct callus at ends of striae 3, 4 and 5. Humeral callosities rather low. Punctuation of elytra uniform and coarse. Antennae not reaching beyond prothorax; segments 1—4 longer than broad, 5—10 broader than long. Hind femur with low longitudinal ventral ridges, the inner bearing one inconspicuous tooth; hind tibia with small sharp posterior tooth, and an equal-sized tooth immediately outside it. Pygidium produced to a point, with two depressed black spots. Surface colouring on elytra, prothorax, head, segments 5—11 of antennae, extreme bases of all legs, hind tibiae and tarsi, and under parts (except for terminal region of abdomen) black. Remainder rufous. Pubescence beneath, sparse and grey with thick golden patches on outer edges of meso- and metasternites, and forming a spot in middle of metepisternum. Pubescence above sparse grey except for dense white patch between ridges of median lobe, white scutellum, white patch immediately behind it, grey transverse zigzags and central fawn triangle. Pubescence of pygidium sparse and golden, black spots depressed and bare.

Bruchidius pruininus (Horn).

1873. *Bruchus pruininus* Horn, *Trans. Amer. Ent. Soc.*, **4** : 327–328.

Prothorax conical, sides slightly convex in anterior half, surface even, median lobe not raised, posterior angles rather less than right angles, lateral margin inconspicuous. Outline of elytra regularly oval, without irregularities, not flattened dorsally, humeral callosities slight. Striae conspicuous, interstriae of uniform width. Punctuation uniform (occasionally slightly mixed), always much finer than that of prothorax. Antennae short, barely reaching end of prothorax, segments regularly wider and larger from the second. Hind femur with two low, longitudinal ventral ridges, the inner bearing a well-marked tooth, apical to which are usually two minute denticles; hind tibia with long, sharp posterior tooth at apex, which also bears sharp spinules. Pygidium as in *B. ervi*. Surface colouring black; three basal

segments of antennae, all tibiae and part of all femora sometimes dark rufous. Pubescence uniform dull grey over all, giving the species a plum-like bloom, slightly thicker on upper surface and outer edge of sternites.

Bruchidius pusillimus (Sharp).

1885. *Bruchus pusillimus* Sharp, Biol. Cent.-Am. Ins. Col., **5** : 479–80.

Prothorax conical, surface even, sides almost straight, much rounded dorso-ventrally; neck region very broad. Posterior margin almost straight, except for strongly projecting median lobe. Punctuation, relative to size of species, extremely coarse. Posterior angles acute. Elytra with regular oval outline, not flattened dorsally, humeral callosities inconspicuous, striae heavily punctured, interstriae with somewhat finer punctures than the prothorax. Antennae reaching to posterior margin of prothorax, serrated from sixth segment. Hind femur with two slight, longitudinal ventral ridges, the inner bearing a proportionally minute tooth near the apex. Hind tibia only about five times as long as broad, with short, strong, posterior tooth and distinct longitudinal ridges. Pygidium oblique, with slightly convex sides; the tip pointed. Abdominal sternites often somewhat abbreviated. Surface colouring black; four basal antennal segments, four anterior legs to bases of femora, sometimes rufous. Pubescence scanty, especially on lower surface, fairly uniform, dull grey, sometimes slightly chequered on the elytra. Median lobe of prothorax may bear a few lighter hairs.

Bruchidius baudoni (Caillol).

1908. *Bruchus Baudoni* Caillol, *Compte rendu Soc. Sci. Nat. Provence,* **1908** : viii.

Prothorax conical, with nearly straight sides, slightly convex at middle, rather more than one and a half times as broad as long. Surface undulating, covered with mixed micro- and macro-punctures; median lobe flanked by slight longitudinal callosities. Posterior margin well-defined; lateral margin distinct at hinder end. Posterior angles acute (Pl. III, Fig. 25). Elytra as in *B. dorsalis,* much more finely punctured than prothorax, callus at anterior end of striae 3, 4 and 5 very pronounced. Antennae reaching posterior margin of prothorax, increasing regularly in size from second segment onwards, serrate in the female (Pl. IV, Fig. 28A), subpectinate in the male. Hind femur with two feeble, ventral, longitudinal ridges, the inner bearing a very blunt tooth. Hind tibia with longitudinal ridges and long, sharp posterior tooth. Surface colour extremely variable. Head, prothorax, elytra and under surface irregularly particoloured black and rufous. Antennal segments 1—10 increasingly dark, 11

usually pale. Legs usually rufous, shaded with dark brown. Pygidium usually rufous; pubescence on under surface ashy, fairly abundant, sometimes brownish bicoloured patches on abdomen and metasternites. Pubescence on prothorax, elytra and pygidium marbled light and dull brown, or dull brown and black.

SUB-FAMILY AMBLYCERINAE.

Antennae subfiliform. Prothorax acutely margined, the posterior border produced strongly backward, not bisinuate. Abdomen shorter than width of coxae. Posterior tibiae and tarsi finely spinose on the inner side. Middle coxae separated. Anterior coxae contiguous. 2·0—2·5 mm.

Only one genus and species of economic importance.

GENUS *ZABROTES* Horn, 1885.

Zabrotes subfasciatus (Boh).

1833. *Spermophagus subfasciatus* Boheman, in Schoenherr, Gen. et Sp. Curc., **1** (1): 111–2.

Prothorax almost semicircularly rounded in front, strongly produced backwards, and unisinuate on either side, nearly twice as broad as long; lateral margin sharp, posterior angles acute. Surface very even, minutely punctured, shining. Scutellum as wide as one interstria, broader than long. Elytra together forming a square; smooth, flat, humeral callosities inconspicuous, punctures and texture as in prothorax. Antennal segments much longer than broad, antennae extending to two-fifths of the length of the elytra. First antennal segment about twice as long as second, and much thicker. Front coxae contiguous at apex. Middle coxae separated by about the width of the labrum. Hind femur narrow, about half width of the coxa, hollowed beneath, with tooth. Hind tibia with comb of minute coarse bristles down posterior face, which terminates in two articulated spurs. First hind tarsal segment almost as long as tibia, and bearing small flattened terminal tooth. First visible abdominal segment equals in width all the remainder together, which are much abbreviated. Pygidium distinctly broader than long, convex in apical half. Surface colouring black. Two basal segments of antennae, and sometimes front tarsi and apices of tibiae rufous. Pubescence below grey and scanty, white and abundant on meso- and metasternites, except coxae. Pubescence on prothorax ashy and brown variegated, with whitish patch on median lobe and at corners. Scutellum whitish. Elytra usually variegated with dull brown, with characteristic irregular light transverse band extending from middle of external margin of either elytron. Pygidium

usually dusky with light anterior border, and thin light central stripe.

SUB-FAMILY PACHYMERINAE.

Key to Genera.

1. Head elongate, temples strongly produced behind the eyes (Pl. IV, Fig. 31A). Hind margin of prothorax semicircularly produced, unisinuate: elytra flattened, with humeral callosities prominent. Eyes emarginate for half their length ..... **Caryopemon** Jekel (p. 20).

— Head short, temples not produced behind the eyes (Pl. IV, Fig. 31B). Eyes emarginate less than one-quarter of their length, prominent. Prothorax not semicircularly produced backwards. Humeral callosities inconspicuous; elytra elongate ..... **Caryedon** Schoenherr (p. 21).

1. GENUS *CARYOPEMON* Jekel, 1855.

Hind femur with two to three strong, simple teeth, and large compound tooth at apical end of row (Pl. IV, Fig. 30). Distinctive cream-coloured cross on suture of elytra. Pygidium, hind femora and under parts clothed with dense cream-coloured pubescence. 4·5—5 mm. ..... **cruciger** (Steph.).

Caryopemon cruciger (Steph.).

1839. *Caryoborus cruciger* Steph., Man. Brit. Coleopt. : 265.

Prothorax almost twice as broad as long, regularly convex, sides slightly and evenly convex, punctuation extremely fine with scattered macro-punctures, lateral margin conspicuous for half its course, invisible from above. Head from prothorax to anterior end of labrum three times as long as width behind the eyes (Pl. IV, Fig. 31A); frontal keel pronounced, antennae pectinate, reaching slightly beyond prothorax; eyes emarginate for about half their diameter; length of temples more than half diameter of eye. Scutellum narrower than one interstria. Mesepimeral extension considerably broader than in Pl. I, Fig. 1B. Elytra together about as broad as long, somewhat tapering, depressed between very large humeral callosities, hardly bent downwards at apex. Punctuation mixed. Hind femur extremely large and thick, the surface deeply scored, bearing ventrally two or three strong, simple teeth, and one large compound tooth apical to these. Hind tibia parallel-sided and strongly curved, grooved, with terminal trowel-shaped tooth. Pygidium narrow, the sides nearly straight, tapering, oblique, the base hardly covered by the elytra, very slightly convex. Surface colouring of head, upper and under surface of prothorax, usually the hind coxae and basal abdominal segments black. Meso- and

metasternites, and hind legs pitchy-brown. The four anterior legs, apex of abdomen, pygidium, all rufous. Pubescence on prothorax and elytra in isolated patches, the cream-coloured areas thickly clothed, the grey and tan more sparsely. Cream-coloured pubescence forms a conspicuous cross at base of elytra. Under surface and hind femur thickly clothed with cream-coloured pubescence, variegated with light brown. Pygidium with uniform cream-coloured pubescence.

2. GENUS *CARYEDON,* Schoenherr, 1826.

Key to Species.

1. Pygidium usually broader than long, the paired dark marks absent or very obscure. Elytra nearly parallel-sided except at extreme posterior end (Pl. IV, Fig. 32B). 3·0—4·5 mm. ..... **C. fuscus** (Goeze).

— Pygidium one and a half times as long as broad, the paired dark marks conspicuous. Elytra narrowed from before the middle (Pl. IV, Fig. 32A). 5·5—7·0 cm. .. **C. gonagra** (F.).

Descriptions of Species.

Caryedon fuscus (Goeze).

1777. *Bruchus fuscus* Goeze, Ent. Beyträge, **1** : 332.

Prothorax subrectangular (Pl. I, Fig. 3), the posterior margin a little arched, and slightly unisinuate on either side, with marginal rim that continues over three-quarters of the lateral margin to its most convex point; posterior angles slightly less than 90°; punctuation fine, with abundant macro-punctures separated by about twice their own width. Elytra elongate, very slightly tapering (Pl. IV, Fig. 32B), deflected downwards at the ends; punctuation fine and uniform. Eighth stria continued on to humeral callosity, which is not prominent. Elytra almost, or entirely, covering pygidium. Ventral extension of mesepimeron narrow (Pl. I, Fig. 1B). Antennae extending to about two-fifths of the length of elytra, serrate, the segments longer than broad, increasing regularly in size from second segment. Eyes finely facetted, hardly emarginate. Hind femur very large, thick (Pl. IV, Fig. 29B), bearing beneath a row of eight to ten teeth, decreasing in size distally, and alternating with curved bristles. Hind tibia parallel-sided, grooved, to fit when at rest within outside row of teeth, armed with trowel-shaped posterior apical tooth. Pygidium broadly triangular, small, the sides convex. Surface colour uniform rufous, usually light. Pubescence uniform dull straw-colour.

Caryedon gonagra (Fabr.).

1798. *Bruchus gonagra* Fabricius, Ent. Syst. Suppl. : 159.

Prothorax as in *C. fuscus,* save that the chief convexity is at middle point of lateral margin. Elytra as in *C. fuscus,* but narrowed appreciably posteriorly from before the middle (Pl. IV, Fig. 32A). Punctuation as in *C. fuscus*. Mesepimeral extension as in *C. fuscus*. Antennae as in *C. fuscus,* but segment 5 noticeably more expanded apically than segment 4. Eyes as in *C. fuscus*. Hind femur as in *C. fuscus,* but with eleven to twelve teeth (Pl. IV, Fig. 29A). Hind tibia as in *C. fuscus*. Pygidium small, nearly one and a half times as broad as long, flattened and slightly depressed on either side, the sides nearly straight, the end blunt. Surface colour dark brown, the elytra variegated with darker dots, the four anterior legs and antennae a little lighter. Pubescence uniform dusty brown, dark over the paired marks on the pygidium.

Distribution of Species and List of Host-Plants.

The host-plants listed in the following table are taken for the most part from published reports. Those for *Acanthoscelides obtectus* (Say) have been tested by the author, but the information on the hosts of the remaining species is second-hand. The list is probably by no means exclusive, owing to the scanty and often unreliable nature of the observations published on this question. The hosts listed in square brackets are from untrustworthy sources.

Species.	Distribution.	Host Plant.
Callosobruchus chinensis (L.).	Cosmopolitan, prinpally from India.	*Phaseolus aureus, P. mungo, Ervum lens* (= lentil), *Cicer arietinum* (=gram and chick pea), *Cajanus indicus, Dolichos lablab, Vigna catjang* (=cowpea), *V. oligospermum, V. sinensis* (= cowpea). [*Arachis hypogeaea, Dolichos bifloris, Glycine hispida, Lathyrus sativus, Ph. aconitifolius, Ph. radiatus, Vicia faba, Vigna unguiculata.*]
C. maculatus (F.).	U.S.A., Central and S. America, India (as *analis*).	*Ph. articulatus, Ph. aureus, Ph. acutifolius, Dolichos lablab, Vicia faba, Pisum sativum, G. hispida, Dolichos sesquipedalis, Ervum lens, L. sativus, Cajanus indicus.* [*Ph. lunatus.*]
C. phaseoli (Chevrol.).	India.	'Broad beans.' [*Dolichos lablab, Ph. lunatus,* experimentally in others.]

Species.	Distribution.	Host Plant.
Acanthoscelides obtectus (Say).	U.S.A., cosmopolitan.	*Ph. vulgaris, Ph. multiflorus, P. sativum, P. arvense, L. sativus, Vicia faba, Ervum lens, Cicer arietinum.* [*Ph. lunatus, Vigna catjang, Albizzia* sp., *Mucuna pruriens, Tephrosia cuspidata, T. virginica,* experimentally in others.]
Bruchus lentis Froelich.	Crimea, Caucasus.	*Ervum lens* (=lentil).
B. ervi Froelich.	Tripoli.	*E. lens.*
B. ulicis Muls.	Asia Minor.	*Vicia ervilia.*
B. nubilus Boh.	Trans-Caucasia.	*Vicia sativa, Lathyrus* sp. [*E. lens.*]
B. signaticornis Schoenh.	S. Europe, Spain.	*E. lens, Vicia monanthos.*
B. brachialis Fåhr.	S. Europe, Asia Minor, U.S.A.	*V. villosa* and other spp.
B. tristiculus Fåhr.	S. Europe.	*P. sativum, Lathyrus* sp.
B. atomarius (L.).	Holland, Germany.	'Field beans.' [*Lathyrus* spp., *Orobus tuberosus, Vicia sativa, V. faba, V. sepium.*]
B. pisorum (L.).	Cosmopolitan.	*Pisum sativum, P. arvense.*
B. dentipes (Baudi).	Transcaspian region, Afghanistan, Cyprus.	*Vicia hyrcana, V. faba,* 'broad beans.'
B. emarginatus Allard.	India.	*P. sativum.*
B. rufimanus Boh.	Cosmopolitan.	*Vicia faba, V. lutea.* ['Dried pulse.']
Bruchidius incarnatus (Boh.).	Egypt.	*Vicia faba, Ervum lens, Cicer arietinum, Pisum sativum.*
B. bixae (Gyll.).	Panama, Paraguay.	*Bixa orellana.*
B. dorsalis (Fåhr.).	China, Bengal.	*Gleditschia* spp.
B. baudoni (Caillol).	Guinea.	*Acacia* spp.
B. pruininus (Horn).	U.S.A.	*Acacia melanoxylon,* 'beans,' *Glycine hispida.*
B. pusillimus (Sharp).	Chili.	*Trifolium pratense.*
Zabrotes subfasciatus (Boh.).	Cosmopolitan.	*Phaseolus vulgaris.*
Caryopemon cruciger (Steph.).	W. Africa.	*Abrus precatorius.*

Species.	Distribution.	Host Plant.
Caryedon fuscus (Goeze).	Cosmopolitan.	*Cassia* sp., *Colutea* sp.
C. gonagra (F.).	India.	*Albizzia lebbek.*

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PLATE I.

FIG. 1A. Thorax of *Bruchus pisorum* (L.), ventral view, showing metepimeron (shaded).

FIG. 1B. The same, of *Caryedon fuscus* (Goeze).

FIG. 2. Hind leg of *Zabrotes subfasciatus* (Boh.).

FIG. 3. Dorsal view of prothorax of *Caryedon fuscus* (Goeze).

FIG. 4. Dorsal view of prothorax of *Callosobruchus chinensis* (L.).

FIG. 5. Hind femur of *Bruchus pisorum* (L.).

FIG. 6. Dorsal view of prothorax of *Acanthoscelides obtectus* (Say).

FIG. 7. Hind femur of *Acanthoscelides obtectus* (Say).

PLATE I.

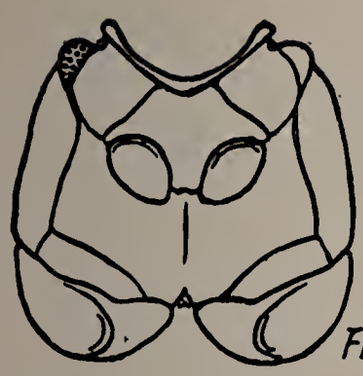

FIG. 1A

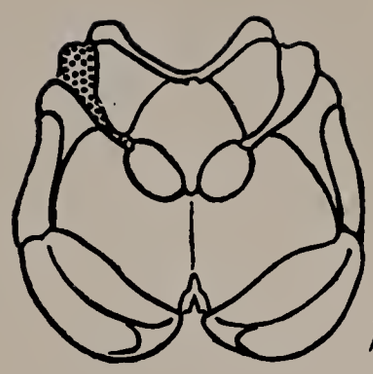

FIG. 1B

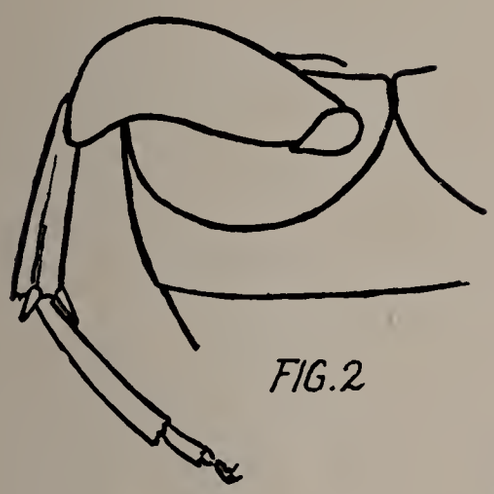

FIG. 2

FIG. 3

FIG. 4.

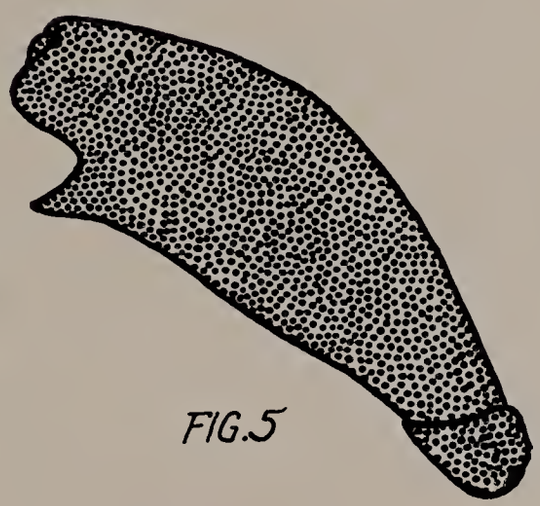

FIG. 5

FIG. 6

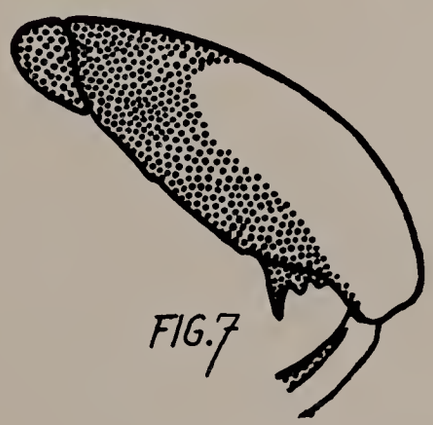

FIG. 7

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PLATE II.

FIG. 8. Folded elytra of *Callosobruchus chinensis* (L.).

FIG. 9. The same, of *Callosobruchus maculatus* (F.).

FIG. 10. The same, of *Callosobruchus phaseoli* (Chevrol.).

FIG. 11A. Pygidium of *Callosobruchus phaseoli* (Chevrol.).

FIG. 11B. The same, of *Callosobruchus chinensis* (L.).

FIG. 12. Dorsal view of prothorax of *Bruchus atomarius* (L.).

FIG. 13A. Hind tibia of *Callosobruchus chinensis* (L.).

FIG. 13B. The same, of *Callosobruchus maculatus* (F.).

FIG. 14. Dorsal view of prothorax of *Bruchus ulicis* Muls.

FIG. 15. The same, of *Bruchus emarginatus* Allard.

PLATE II.

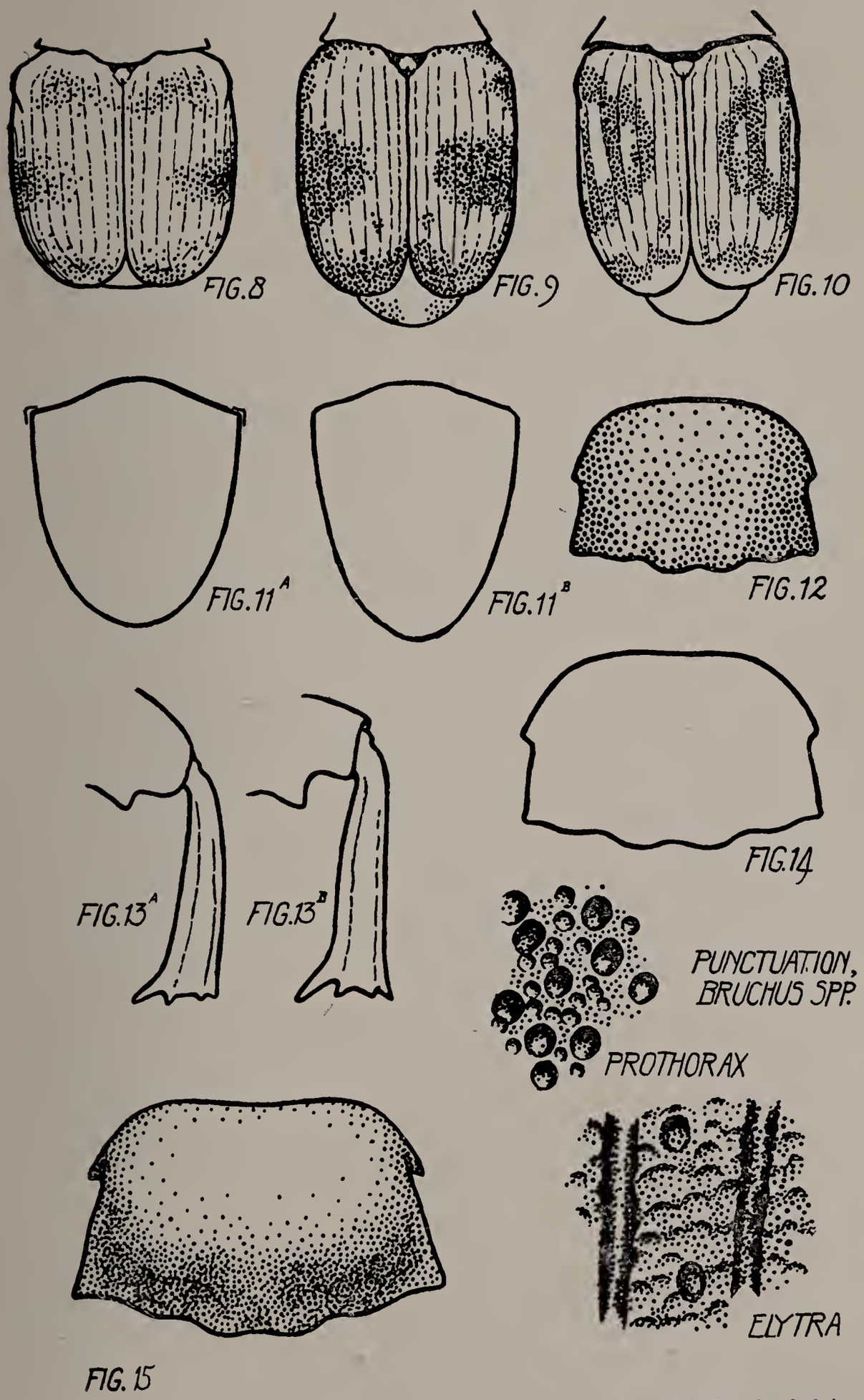

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PLATE III.

FIG. 16A. Front femur and tibia, with part of coxa, of *Bruchus signaticornis* Schoenh., ♂.

FIG. 16B. Front femur and tibia of *Bruchus brachialis* Fåhr., ♂.

FIG. 17. Middle tibia of *Bruchus signaticornis* Schoenh., ♂.

FIG. 18. The same, of *Bruchus brachialis* Fåhr., ♂.

FIG. 19. Dorsal view of elytra and pygidium of *Bruchus tristiculus* Fåhr.

FIG. 20. Pubescent markings of elytra of *Bruchus ervi* Froelich.

FIG. 21. Middle tibia of *Bruchus nubilus* Boh., ♂.

FIG. 22. The same, of *Bruchus ulicis* Muls., ♂.

FIG. 23. The same, of *Bruchus atomarius* (L.), ♂.

FIG. 24. Dorsal view of *Bruchidius dorsalis* (Fåhr.), showing pubescent markings.

FIG. 25. Dorsal view of prothorax of *Bruchidius baudoni* (Caillol).

FIG. 26. The same, of *Bruchidius incarnatus* (Boh).

PLATE III.

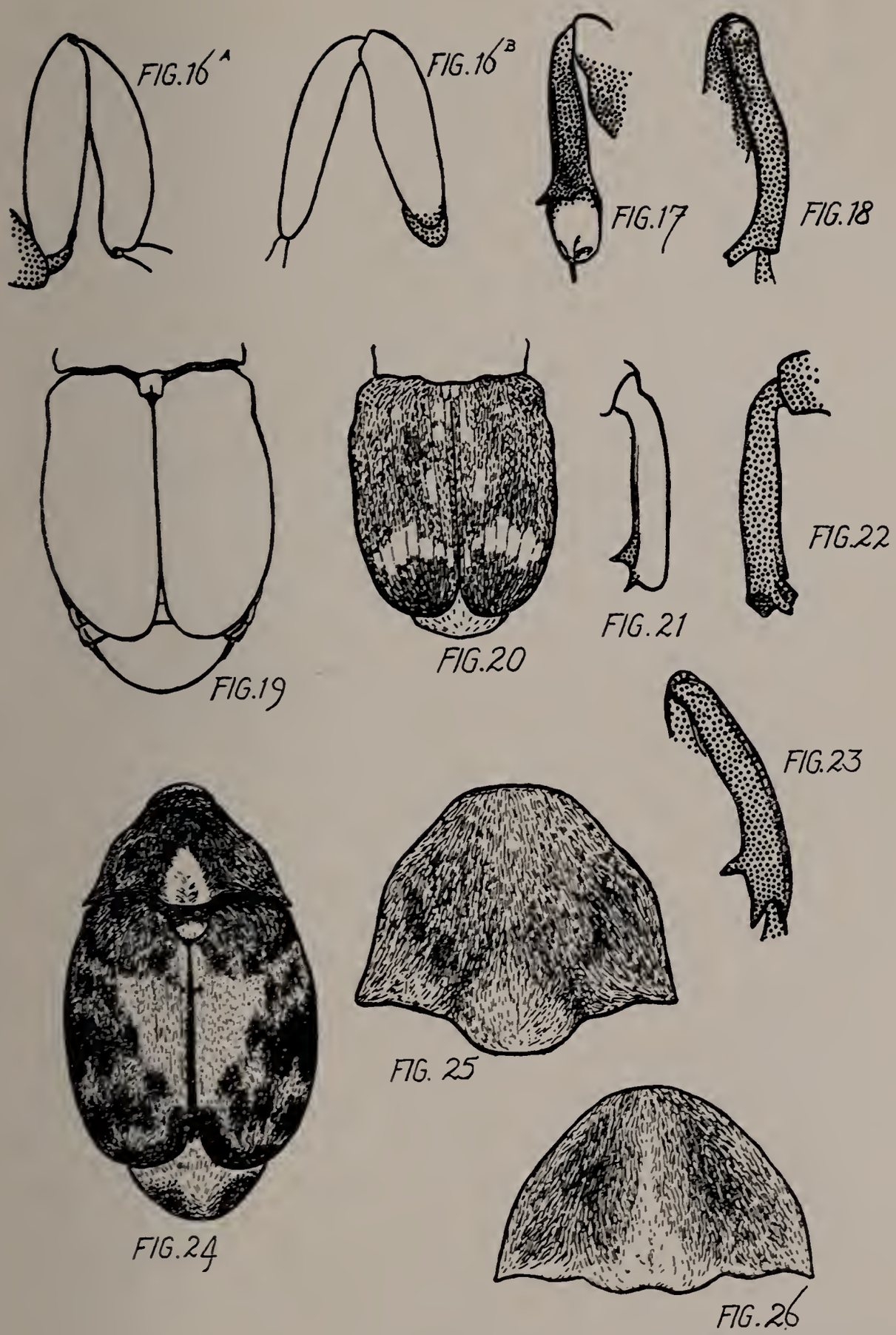

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PLATE IV.

FIG. 27. Dorsal view of prothorax of *Bruchidius bixae* (Gyll.).

FIG. 28A. Antenna of *Bruchidius baudoni* (Caillol).

FIG. 28B. Antenna of *Bruchidius incarnatus* (Boh.).

FIG. 29A. Hind femur of *Caryedon gonagra* (F.).

FIG. 29B. The same, of *Caryedon fuscus* (Goeze).

FIG. 30. The same, of *Caryopemon cruciger* (Steph.).

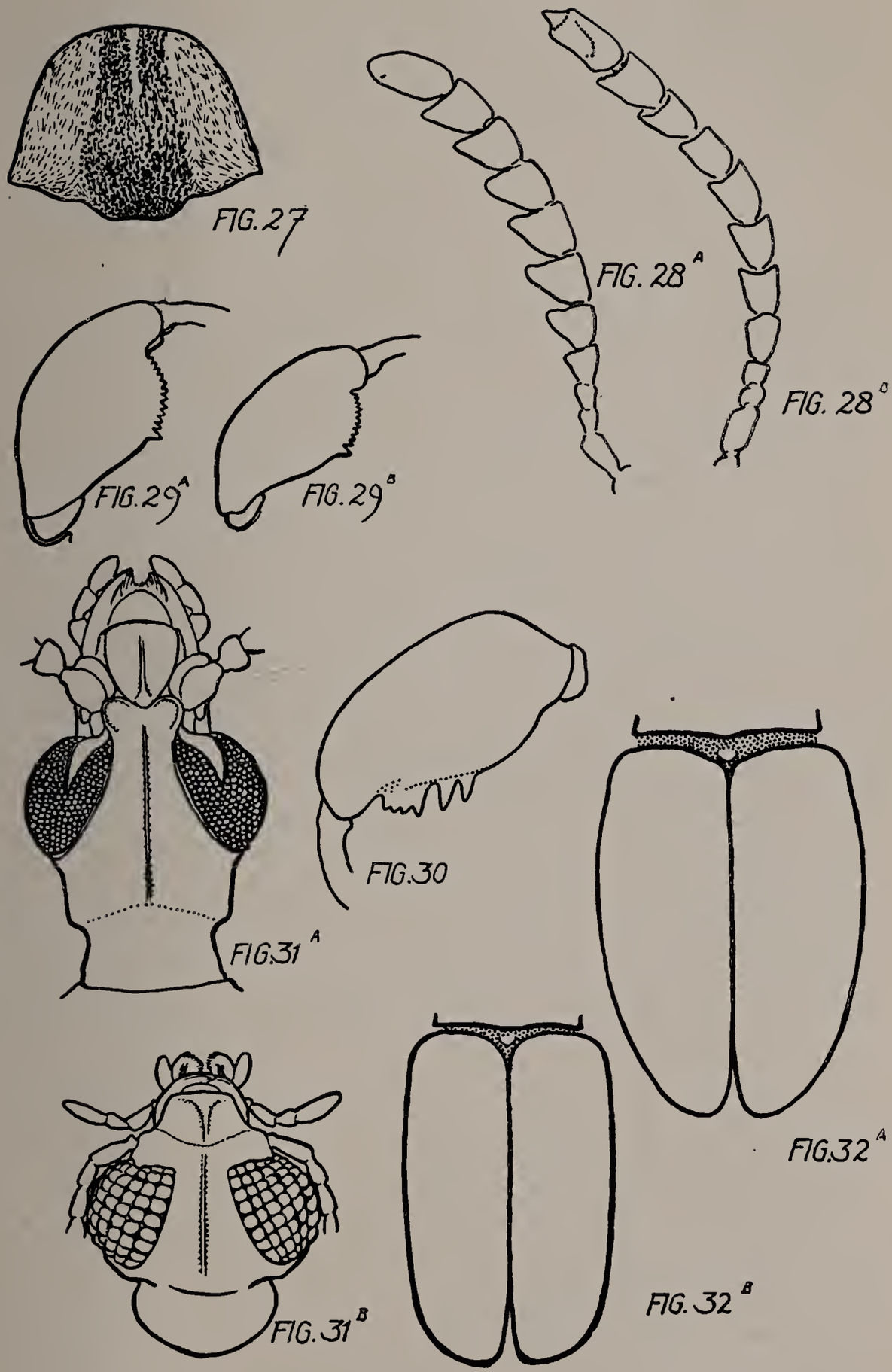
FIG. 31A. Head of *Caryopemon cruciger* (Steph.), dorsal view.

FIG. 31B. The same, of *Caryedon fuscus* (Goeze).

FIG. 32A. Elytra of *Caryedon gonagra* (F.), folded, dorsal view.

FIG. 32B. The same, of *Caryedon fuscus* (Goeze).

PLATE IV.



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EUROPEAN BRUCHIDAE.

NOTES ON ICHNEUMONIDAE (HYM.) NEW TO OR RARE IN BRITAIN; WITH A BRIEF REVIEW OF BRITISH LISTS PUBLISHED SINCE 1915.

By G. J. Kerrich, M.A., F.L.S., F.R.E.S.
(Curator, University Museum of Zoology, Cambridge.)

Introduction.

The standard work on British Ichneumonidae is that of Morley (1903-14), who also compiled a catalogue (1915) which I believe was complete to date. The work of Morley was good in most respects, but he himself admits the unsatisfactory nature of his grouping of the Tryphoninae (1911, **4**): the arrangement of Schmiedeknecht is much to be preferred. One may also complain that, while scornful of Förster for erecting too many genera, Morley has sunk too many in a way that is inconvenient to those whose interests are not confined to the British fauna. Various changes of nomenclature are necessary in accordance with the work of Roman (1912, 1932, 1933), Viereck (1914, 1921), Heinrich (1926, 1933) and others: some of these changes may be adopted immediately, but others are still controversial; it is perhaps particularly fortunate that Roman (1933) has shown that Viereck's reason for applying the name Ichneumoninae to the subfamily generally known as Pimplinae is ill-founded.

The world genera have been classified by Ashmead (1900), who in his preface acknowledges how much he owes to the work of Förster. Standard works dealing with European species are those of Berthoumieu (1894-96), who deals only with Ichneumoninae; and Schmiedeknecht (1902-27), who is still engaged in revising (1928-) his former work, and has also contributed (1924) 'A short summary of the Section Tryphonides Prosopi.' Schmiedeknecht's reference to earlier work is brief, and he owes far more to Ashmead and especially to Thomson than is at first sight apparent. Thomson's work on the Swedish species (1869-97) is still an essential for the elucidation of many species, especially the Campoplegini; and the partial revisions by Roman of *Hemiteles* (1925) and *Cteniscus* (1913, 1931) are very important with respect to British species.

Pfankuch (1919) has given a comparative account of the external structural features of the Ichneumonidae which is well illustrated by figures, and is very valuable in explaining the terms used by German authors. The characters used in the discrimination of Ichneumoninae have been discussed at length by Heinrich (1928, 1934); and the work of Ceballos (1924) on the Spanish representatives of this sub-family contains many useful

figures. Of recent years American authors have given prominence to the taxonomic value of the structure of the apex of the ovipositor (Cushman and Rohwer, 1920, etc.); and this has been used as the basis for an entirely new classification of the Ichneumonidae Deltoideae suggested by Seyrig (1934).

A brief review of British Lists published since 1915.

Since the publication of Morley's catalogue (1915), a large number of species have been discovered new to Britain. Many of them are included in local lists, and I am reviewing briefly here the local lists that have appeared since 1915, as a first step towards the collection of our knowledge of British Ichneumonidae since that date. Other species new to the country have been recorded singly, some in general and some in economic literature; one economic paper is included in this review (Thorpe, 1930), since it contains a local list. I have explored the literature as far as possible, but it is conceivable that I have missed some lists: I shall be sincerely grateful to anyone who will inform me of such omissions.

Morley has made additions and confirmations to his catalogue in 1916 and 1921. The leanness of the years following his 1915 list caused him to write in 1921: 'Subsequent matter is so scanty that I am beginning to modify the conviction held throughout the course of my study of the "British Ichneumons" that we were as yet no more than "scraping the surface," as Bingham used to say, of the subject; and that perhaps, after all, the 1,523 species there described may pretty fully represent our indigenous fauna in this family.' He must have regretted this remark when L. A. Carr's list was published in 1924. When one sees how regularly species are recorded as new to the British list in such a well-worked order as the Coleoptera, one feels safe in assuming that the number of species of Ichneumonidae actually occurring in this country is much nearer three thousand than two thousand; and that it is merely a question of time and of different methods of collecting, particularly breeding, before many more species are discovered. Morley (1917) has also contributed a list of a hundred and ten species collected in the Lichfield (Staffordshire) district in 1916; and (1929) a list of parasitic Hymenoptera collected in the neighbourhood of St. Ives, Cornwall, by the Rev. A. Thornley, including sixty-three Ichneumonid species.

L. A. Carr's 'List of Ichneumonidae of the Lichfield district' (1924) is a monumental work, containing one thousand two hundred and fifty-five species, of which no less than three hundred and thirty-five were new to Britain. However, Dr. Roman tells me that a number of these species were determined by him with a query, and it is most unfortunate that Mr. Carr

omitted these queries in publication, so that the species in question will have to be checked before an accurate British catalogue can be published. Mr. Carr tells me that his material is scattered in various museums in this country; the main collection is in the Nottingham Museum in the care of Mr. H. Parry Jones. The species new to science were described by Habermehl (1923), Roman (1923), and Schmiedeknecht (1924).

In his introduction Carr states: 'It is usually affirmed that the method *par excellence* of collecting Ichneumons is to search the "flower tables" of *Angelica* and other Umbelliferae. So far is this from being the case here that I, personally, have not taken a dozen specimens in this manner.' My own experience, especially in Cambridgeshire, agrees with that of most authors; but Mr. J. F. Perkins tells me that in Devonshire, also, Umbelliferae are relatively unattractive. Here is a pretty problem for an ecologist!

J. W. Carr in his 'Invertebrate fauna of Nottinghamshire' (1916) records four hundred and thirty-four Ichneumonidae, and in his supplement (1935) a further hundred and seventy-seven. Nearly all are determined by Morley, and nearly all are deposited in the Nottingham Museum. In connection with these lists and that of L. A. Carr, see below my notes on *Hemiteles oxyphimus* Grav.

Johnson has written a large number of lists of Ichneumonidae from Ireland. He published the results of a year's collecting nearly every year, which in the aggregate form a very valuable contribution to the knowledge of Irish Ichneumonidae. He has added a number of species to the British list, most of which bear the authority of Roman's determination. For the sake of completeness I have included in my bibliography papers written by Johnson before 1915.

Haines (1931) has written a list of eight hundred and fifteen species from Dorset and Hampshire: Winfrith (south Dorset) and the New Forest have been his special localities. This long list contains many records of rare species, but no definite new British records; Dr. Haines has, however, been badly handicapped for want of foreign literature on this group. Dr. Haines has very kindly shown me his collection, which contains a little undetermined material, and it may be possible to communicate further notes on his list to the Society for British Entomology; indeed one such note is included in the present paper (see *Hemiteles coriarius* Tasch.): but unfortunately much of the material with which he was dealing has been returned to various correspondents and may not be traceable. The queries in this list are frequently obscurely placed, and should refer to determinations, not to localities.

The Orthocentrini are generally regarded as parasites of Diptera, particularly Mycetophilidae, and other host records have been looked on with suspicion [1] : the record of a species of *Orthocentrus* bred as a hyperparasite of *Abraxas grossulariata* L. (Geometridae *s. lat.*) through *Apanteles* sp. (Braconidae) made by a naturalist of Dr. Haines' ability is, therefore, of exceptional interest.

In contrast to the above, Omer-Cooper's Huntingdonshire list (1926) includes forty-four Ichneumonidae; this cannot represent one-twentieth of the species actually occurring in the county, but yet contains three novelties for Britain; these were determined by Schmiedeknecht or Pfankuch.

Hancock's list of Ichneumonidae of the Cambridgeshire Fens (1925) contains two hundred and seventy-nine species, of which two hundred and twenty-eight are from Wicken and Adventurers' Fens: twenty species are recorded as new to Britain. Hancock's collection is now at the British Museum in the care of Mr. J. F. Perkins, who tells me that some of the species recorded are synonyms or misdeterminations. My own 'Additions to the Ichneumonoid Fauna of Wicken Fen' was, as therein explained, the result of barely a year's work; it contains fifty-five Ichneumonidae, including one new to Britain determined by Roman. The material is deposited in the Cambridge University Museum of Zoology.

Hamm (1926) has written a list of a hundred and twelve species from the Oxford district, all determined by Morley; he states that most of the material still remains to be worked out, but the paucity of Tryphoninae and Ophioninae in this list is curious.

Saunt (1923) has written a list of Ichneumonidae taken in Warwickshire and determined by Morley. This paper is in five sections, and contains records of two hundred and thirty-nine species; the last section consists of a supplementary list, and it is a pity that the species freshly recorded in it are not in any way separated from those already recorded in the previous sections. Saunt's collection is now at the British Museum in the care of Mr. J. F. Perkins.

Fordham (1926) has written a list of thirty Ichneumonidae from Durham and Northumberland, and a list of sixteen taken in the Swansea district, all determined by Morley. The latter list is included in a list of the Ichneumonidae of Glamorgan by Norton (1933), which contains a hundred and ten Ichneumonid species, mostly named by Morley; the Bassini are comparatively well represented with ten species, the Cryptinae very poorly with

[1] Morley (1911, **4** : 52) quotes Thomson as giving for their hosts 'svamp-insecter,' to which he adds (? Cynipidae). The meaning of the Swedish word is 'mushroom insects.'

ten species : but the deficiency of Cryptinae is partly made up in a list of additions by HALLETT and NORTON (1934). This list comprises thirteen species, determined by A. W. Stelfox and J. F. Perkins.

BENSON's list of Ichneumonoidea from the Perthshire Highlands (1933), determined by Roman, contains a number of species new to Britain, but not all could be determined with certainty. LACK (1932) records eight Ichneumonidae from St. Kilda, determined by Roman.

STAINER (1934) gives a list of thirty Ichneumonidae from the Marlborough district, all determined by Morley. Attention paid to these insects by members of a college natural history society is very commendable, but none of the records appears to be of bred specimens. This excellent school society must surely include a number of breeders of Lepidoptera, and perhaps of other orders ; and it is to be hoped that they will be persuaded to preserve their doubtless unwanted parasites and to give them to those who can make use of them.

THORPE's work (1930) on the parasites of *Rhyacionia buoliana* Schiff. (Tortricidae) includes a list of nineteen Ichneumonidae bred from material collected near Brandon, Suffolk, and Swaffam, Norfolk ; three of these species were new to Britain.

ROMAN's paper (1923) on parasites bred from Mycetophilidae by Dr. F. W. Edwards contains nine Ichneumonidae, one species new to science, and all but two (not all, as stated by Roman) new to Britain.

MORLEY and RAIT-SMITH have recently (1933) written a list of the Hymenopterous parasites of British Lepidoptera, in the compilation of which they do not appear to have consulted any of the recent economic literature. Other host-parasite lists include a paper by WATERSTON (1921) on the parasites of grain pests.

HODGSON (1917) has written a very well annotated list of the type species in the Bignell Collection, which is deposited in the Plymouth Museum ; the types are mostly of Bignell, Bridgman, and Marshall.

I have not included in this paper notes on single additions to the British list except in the case of W. E. Johnson ; but since corrections are so much more important than additions, it may not be out of place to mention here that Stelfox (1929) has shown that *Itoplectis* (*Pimpla*) *clavicornis* Thoms. should replace *curticauda* Kriechb. on the British list.

May I conclude this section by expressing the hope that all entomologists recording Ichneumonidae will carefully preserve the specimens upon which their records are based, and will see that they are ultimately deposited in some museum?

Records of Ichneumonidae.

The following are a number of records of Ichneumonidae new to or rare in Britain which have come my way during the last few years while improving the Cambridge University collection or examining material for private workers.

In the case of all fresh records, where no captor is mentioned (except, of course, in the case of specimens from old collections with data unrecorded) or no determination acknowledged, I am responsible; and, except where otherwise stated, specimens are deposited in the Cambridge University Museum of Zoology. Studland Heath (Dorset) localities are given as accurately as possible on account of their potential value in connection with Diver's survey (see Diver and Good, 1934).

Explanation of Signs.

Species marked with an asterisk are believed to be new to the British list; that marked with a dagger, now noted as a good species, was considered by Morley only to merit varietal value.

Ichneumoninae.

Protichneumon disparis Poda.—A specimen ex coll. P. J. Selby, Britain before 1868, was thus determined by Morley in 1916 with the remark, 'This is the first definitely British specimen I have seen, what a pity there is no locality. C.M.' The specimen is a male *Callajoppa,* which Heinrich has kindly determined as a variety of *C. lutorius* Fabr.; it is remarkable in having the thorax and propodeum almost entirely red-brown. The British status of *P. disparis* seems, therefore, to rest solely upon the records of Stephens: on the European continent it is a not uncommon parasite of the forest pest *Lymantria monacha* L. and other Lepidoptera.

†**Coelichneumon biannulatus** Grav. (=*funebris* Holmgr.).—Placed by Morley (1903, **1**: 29) as a variety of *comitator* auctt. (*nec comitator* L., Roman, 1932), but it is a good species. In the Cambridge University Museum collection are three specimens: 1 ♂, previously incorrectly determined, received in exchange from the British Museum, without data; 1 ♂, New Forest, Hants, vii.1905, C. G. Lamb, det. Schmiedeknecht, 1923; and 1 ♂, Wood Marsh, South Haven Peninsula, Studland Heath, Dorset, 10.viii.1933: all three determinations have been confirmed by Heinrich.

***Stenichneumon puerulus Kriechb.**—1 ♂, Wicken Fen, Cambs., v.1931; det. Heinrich, ii.1933.

Cratichneumon nigritarius Fabr. var. **pallitarsis** Thoms.—1 ♀, Great Rundale Tarn (*ca.* 2,240 ft.), Westmorland, 5.viii.

1921, G. E. Hutchinson; det. Schmiedeknecht, 1923. First recorded as British by Benson (1933).

Melanichneumon monostagon Grav.—This species was included in Morley's monograph (1903, **1**: 79); but it was excluded from his 1915 catalogue, possibly in error, since no mention is made of the matter among the notes at the end of volume five of his monograph. It is certainly a British species; L. A. Carr (1924) records two specimens from the Lichfield district, and there are three British specimens in the Cambridge collection.

Ichneumon validicornis Holmgr. (=*vivacior* Tischb.).—1 ♀, ex coll. P. J. Selby, Britain before 1868, data unrecorded; 1 ♂ (following Thomson) from Henley-on-Thames, Oxfordshire, 1.viii.1910, H. Scott: both det. as *vivacior* Tischb. by Schmiedeknecht, 1923; I follow Heinrich in making this synonymy. 1 ♂, from a clump of sallows and birches at the north end of Central Marsh, South Haven Peninsula, Studland Heath, Dorset, 14.viii.1932, C. Diver; deposited in Diver's Studland Heath type collection.

Amblyteles margineguttatus Grav.—1 ♀, Logie, Elgin, 17.ix.1909, F. Jenkinson. Det. by Schmiedeknecht as *oratorius* Fabr.; Heinrich confirmed my tentative determination as *margineguttatus* Grav. Morley gives only two definite British records (1903, **1**: 203).

Apaeleticus bellicosus Wesm.—1 ♀, Wicken Fen, Cambs., 26.viii.1931. Previously known in Britain by a single specimen (Morley, 1903, **1**: 239).

Heterischnus rufipes Wesm.—1 ♀, ex coll. P. J. Selby, Britain before 1868, data unrecorded; Schmiedeknecht det., 1923. 1 ♂, Gamlingay, W. Cambs., 31.vii.1931. Included as British by Morley (1903, **1**: 285) from Marshall's catalogue; confirmed by L. A. Carr (1924).

Misetus oculatus Wesm.—1 ♂, old beech woods, Vinney Ridge, New Forest, Hants, 21.vi.1923, H. Scott; det. H. Bischoff and G. J. Kerrich, 1932. Recorded by Morley (1916, 1920) and L. A. Carr (1924). 'Selten im mittleren und nördlichen Europa' (Schmiedeknecht, 1904, **1**: 343).

Cryptinae.

Hemiteles albipalpus Thoms.—1 ♀, ex *Coleophora* sp. on *Juncus*, Coe Fen, Cambridge, em. vi.1933. Agrees well with descriptions, and with a specimen in the Pfankuch collection in the Berlin University Museum. Confirms L. A. Carr's record (1924) of two males.

H. balteatus Thoms.—2 ♀♀, Adventurers' Fen, Wicken, Cambs., 7 and 26.viii.1931; 1 ♀, Main Drove, Wicken Fen, Cambs., 26.vii.1933. Agree well with descriptions, and with

specimens in the Pfankuch collection; the peculiar leathery sculpturation of the propodeum and first segment of gaster, and the very short terebra render this species distinct. These confirm Bridgman's record of a single female from Heigham, near Norwich (Morley, 1907, **2**: 159). Nielsen (1932) records this species (det. Schmiedeknecht) as bred from the spider *Clubiona gracilis* Hentz; Bristowe (1925) records eight species of *Clubiona* from Wicken Fen, but *gracilis* Hentz is not included; Dr. Finnegan tells me she believes it has not been recorded from Britain.

H. longulus Thoms.—First recorded from the British Isles by Johnson (1931) from Rostrevor in Ireland. In the Cambridge collection are two females; one from an old collection without data, one from Logie, Elgin, ix.1905, F. Jenkinson; these previously stood under the name of *Hemiteles oxyphimus* Grav. (Schmiedeknecht det., 1923). Being very doubtful of this determination, I took them with me to Stockholm in 1933, when Roman determined them as *longulus* Thoms.; through the kindness of Dr. N. A. Kemner I was later able to confirm this by comparison with the type in Lund. Two females from the Lichfield district (L. A. Carr, 1921, 1923) previously standing under the name of *oxyphimus* Grav. (*q.v.*) are also referable to this species.

H. oxyphimus Grav.—I have seen the male type of this little-understood species through the kindness of Prof. Bischoff, who borrowed it from Breslau so that I could see it in Berlin. It is a very shining species; the clypeus has two small apical teeth; the notauli are very short; the petiole is suddenly explanate to the acute spiracles; the postpetiole is quadrate, with a few fine longitudinal striae. A second male from the collection was sent, belonging to a different species, but in this specimen the petiole is much more gradually explanate, and does not correspond to Gravenhorst's description (1829, **2**: 815).

In the Pfankuch collection in Berlin three species stand under this name; two females which agree well with the type male, one male and one female of *H. longulus* Thoms., and one male of another species. The male type and the two correctly determined females in the Pfankuch collection are the only specimens known to me.

Two specimens in the Cambridge collection under *oxyphimus* Grav. (Schmiedeknecht det., 1923) proved to be referable to *longulus* Thoms. (*q.v.*); in the Cambridge Natural History Society files G. L. R. Hancock records two specimens, but as these were also determined by Schmiedeknecht they may also be referable to *longulus* Thoms.[2] Through the kindness of Mr.

[2] I have also seen a specimen in the British Museum exotic collection det. by Schmiedeknecht as *oxyphimus* Grav. which is referable to *longulus* Thoms. See also remarks on specimens in L. A. Carr collection.

J. F. Perkins I have seen all the specimens recorded as British by Morley (1907, **2**: 161); they are all misdetermined, and are referable to *incisus* Bridg. or a species closely related thereto.

Mr. H. Parry Jones has been so kind as to send me on loan from the Nottingham Museum:

(1) the three specimens standing under the name of *oxyphimus* Grav. in L. A. Carr's main collection; two females (*teste* Schmiedeknecht) are referable to *longulus* Thoms., and one male (*teste* Roman)[3] is also misplaced;

(2) the eight specimens recorded by J. W. Carr (1916, 1935); the two females are *H. incisus* Bridg., that is to say, they are the species under that name in the Bridgman collection agreeing best with the description; the six males I cannot place, but more than one species is present, and none is *oxyphimus* Grav.

The only remaining published British record to my knowledge is that of Morley from Ryde, Isle of Wight (Haines, 1931). Through the kindness of our mutual friend Mr. W. S. Gilles, I have been able to see specimens standing under this name in Mr. Morley's collection, which, in conjunction with the Nottinghamshire misdeterminations mentioned above, show that that author has not been more successful than others in interpreting Gravenhorst's description. *Hemiteles oxyphimus* Grav. must, therefore, be deleted from the British list.

***H. coriarius** Taschb.—1 ♀, Bolderwood Walk, New Forest, Hants, 31.v.1927, F. H. Haines. This is the specimen recorded by Haines (1931) doubtfully as *H. melanogaster* Thoms., and is in Dr. Haines' private collection.

Spilocryptus saturniae Boie.—This is not at all a rare insect, but as it was not recognised as British till 1933 (Nicholson), further records may not be out of place here. The following specimens exist in the Cambridge collection (three placed in duplicates):

Not recorded as bred: 2 ♂♂, Britain (old collections), det. Schmiedeknecht, 1923, as *S. solitarius* Tschek; 1 ♂, 1 ♀, Colchester, W. B. or B. S. Harwood, det. ? Harwood as *S. migrator* Fabr.

Bred from *Saturnia pavonia* L.: 1 ♂, 1 ♀, Colchester, W. B. or B. S. Harwood, det. ? Harwood as *S. migrator* Fabr.; 5 ♂♂, 3 ♀♀, Cambridge, 1892, no captor recorded (1 ♀, det. Morley,

[3]As pointed out above, much of Carr's material was determined by Roman more or less doubtfully, and published by Carr as certain. It is, therefore, particularly unfortunate that the specimen does not bear Roman's original determination label (Mr. H. Parry Jones tells me that Carr merely numbered his specimens, the numbers referring to his rough MSS.). But this is a very probable case in point, as Dr. Roman told me in 1933 that he did not certainly know *H. oxyphimus* Grav.

1916, as *S. fumipennis* Grav.; 1 ♂, det. Morley, 1916, as *S. migrator* Fabr.; remainder det. Schmiedeknecht, 1923, as *S. migrator* Fabr.); 1 ♂, 1 ♀, Cambridge, D. Sharp; 3 ♂♂, 2 ♀♀, Brockenhurst, Hants, em. 14-21.vi.1933, M. Niblett.

The females are said to differ from *mandator* L. (= *cimbicis* Tschek) in that the head is narrowed behind the eyes in *mandator*, not or scarcely narrowed in *saturniae*; but this character I find difficult to appreciate except by direct comparison. Typical specimens differ also in the female in that the costae of the propodeum are normally strong in *mandator*, weak in *saturniae*; and in both sexes in that all the tibiae are distinctly basally white in *mandator*, only the hind tibiae in *saturniae*.

***Hoplocryptus quadriguttatus** Grav.—1 ♀, Gamlingay, W. Cambridgeshire, 31.vii.1931; det. H. Bischoff and G. J. Kerrich, 1932.

PIMPLINAE.

Rhyssella curvipes Grav.—This species was transferred from *Thalessa* Holmgr. to his new genus by Rohwer (1920). 1 ♀ (length about 13·5 mm.), 12-acre Wood, South Haven Peninsula, Studland Heath, Dorset, 21.v.1934; det. J. F. Perkins, xi.1934. Previous British records are: 1 specimen, Matley Bog, New Forest, Hants (Morley, 1908, **3**: 29); 1 ♀, Hampshire, B. M. Hobby (Haines, 1931: 16); 1 ♀, Wollaton Park, Notts., H. P. Jones (J. W. Carr, 1935: 220).

Clistopyga rufator Holmgr.—2 ♀♀, bred from spider's eggs, Wicken Fen, Cambs., em. 1.vii.1932, G. C. Varley; 1 ♂, swept, Wicken Fen, 17.vii.1932. There are only two previous British records: 1 ♀, Brundall, Norfolk, 3.vi.1881, J. B. Bridgman (Morley, 1908, **3**: 140); and 1 ♀, Wicken Fen, 27.vii.1924, R. B. Benson (Hancock, 1925: 133, 138).

TRYPHONINAE.

***Exenterus abruptorius** Thunb. (=*cingulatorius* Holmgr.). —1 ♀, Second Ridge, South Haven Peninsula, Studland Heath, Dorset, 28.vi.1933, R. M. Gambles; I have compared this specimen with material in the Stockholm Riksmuseum. Mr. J. F. Perkins has just discovered that the specimen bred from *Diprion pini* L. (Tenthredinidae) at Staindrop in Durham, recorded by Morley (1911, **4**: 206) as *E. marginatorius* Fabr., is also referable to this species. The specimen of *E. marginatorius* Fabr. in the collection of L. A. Carr has been kindly sent me on loan by Mr. H. Parry Jones, and is correctly determined (by Roman), which confirms that species' occurrence in this country.

In addition to the characters given by Thomson and Schmiedeknecht, *abruptorius* differs from *marginatorius* in being a much stouter insect; in the scanty Cambridge museum material

I find the second tergite of the gaster to be almost twice as broad as long in *abruptorius*, scarcely broader than long in *marginatorius*. In response to my request to check this conclusion, Dr. Roman writes: 'I think you are right about the different size of tergite 2 in *Exent. abrupt.* and *marginat.* ♀.'

***Lathrolestus ensator** Brauns.—

1897. *Tryphonopsis ensator* Brauns, *Arch. Ver. Naturg. Mecklenb.*, **51** : 62.
1905. *Lathrolestus dilatatus* Nordenström, *Ent. Tidskr.*, **26** : 207.
1908. *Tryphonopsis ensator* Schmiedeknecht, *Opusc. Ichn.*, **3** : 1379.
1910. *Lathrolestus ensator* Roman, *Ent. Tidskr.*, **31** : 173.

A single female taken by F. Jenkinson in a Cambridge garden, 5.vi.1915, was recognised as this species by Prof. Bischoff, who kindly allowed me to compare it with the type in the Berlin University Museum. The black coloration on the Cambridge specimen is darker and more extensive than that on the type; in particular the two small black spots on the second tergite are here coalesced into a transverse band extending over most of the basal half of the tergite, as is also the case with a specimen in the Stockholm Riksmuseum.

This species was previously known from north Germany and south Sweden; Dr. Roman tells me he has also taken it in Denmark.

***Hadrodactylus confusus** Holmgr.—1 ♂, vii.1931; det. Roman, 1933. Locality label unfortunately mislaid; either New Forest (Hants) or Cambridgeshire. 'Nord- und jedenfalls auch Mitteleuropa' (Schmiedeknecht, 1913, **5**: 2680).

Stenomacrus britteni Waterst.—This species was described by Waterston (1929) from specimens bred by Mr. H. Britten from the Sciarid fly *Platosciara lignicola* Winn.; and has since been recorded (with the generic name misspelt) by Donisthorpe (1933), bred from spruce bark in Windsor Forest, Berkshire, in company with the above-named fly and other insects. A single female was found dead on 10.vii.1933 in the Entomological Field Laboratory, Cambridge, by Mr. G. C. Varley; I have been able to compare this specimen with the type in the British Museum. The male of this species is unknown.

ACKNOWLEDGEMENTS.

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posited in the Nottingham museum; to all those who have placed museum facilities so readily at my disposal when I have visited them; and to Dr. A. D. Imms for reading my manuscript.

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A RECORD OF THE HEMIPTERA HETEROPTERA AT THE IMPERIAL COLLEGE BIOLOGICAL FIELD STATION, SLOUGH, BUCKS, WITH NOTES ON THEIR FOOD.

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The main object of this work was to record the Heteroptera collected in the grounds of the Field Station, and, because many Heteropterous species commonly considered phytophagous also show carnivorous habits, an attempt has been made to determine the feeding habits of the species collected. For this purpose, in addition to plant hosts, the bugs were offered various insects such as aphides, small Lepidopterous and other larvae.

The work was carried out during the summer months (May to September inclusive) of two consecutive years, 1933, 1934. During that time, seventy species were collected; of these, five belonged to the family Pentatomidae, three to Lygaeidae, six to Reduviidae, four to Cimicidae, and fifty-two to Capsidae. A record of all other Heteroptera collected at the Field Station is also included in this paper.

I wish to thank Dr. O. W. Richards for suggesting the work, and for his kind assistance throughout. My thanks are also due to Mr. W. E. China for the identification of certain species. The rest of the material was identified by Dr. Richards and myself. The nomenclature follows that of E. A. Butler (1923).

Each specimen collected was placed in a 3in. by 1 in. glass tube capped with muslin, and filled to a depth of half to three-quarters of an inch with damp sand. A leaf of the plant on which the particular bug was collected, or a strip of muslin carrying aphides, was placed in or on the sand. The tubes were kept in a shaded place in the laboratory, at laboratory temperature.

The species of plant on which each bug was found was recorded, but because it is known that many bug species occur on plants other than those on which they feed, records were kept of their longevity on these and other plants, for the comparison with the longevity of those supplied with aphides. It cannot be assumed that bugs provided with leaves of their presumed host plants necessarily feed upon them, because the bugs spent the greater part of their time in captivity hidden in the folds of the leaves. When observations of the feeding habits were attempted, it was necessary to move the tubes. This disturbed the bugs and rendered further observations impracticable. The leaves

were examined for damage caused by the feeding. Owing to their rapid shrivelling and discoloration, it was rarely certain, however, whether or not the marks seen on the leaves were caused by the bugs.

In the following tables it will be seen that some individuals which had been given aphides as food lived for several days without being seen to feed. This is because records were made only when the particular bug was observed to suck the aphides. Although the bug was not actually seen feeding, dead aphides were often found in the tubes when replenishing the supply of food. It is uncertain whether the aphides were killed by the bugs, or whether they died from other causes.

The following signs have been used to indicate the various feeding habits of the bugs :—

In those species marked C., in the tables, the specimens given aphides were observed to feed on various days, and the average length of life was longer than that of the individuals given plants. These species are definitely carnivorous.

In those marked C.v., the tables show that most of the bugs given aphides were observed to feed, but one or two of those given plants lived longer than those given aphides. These species are chiefly carnivorous, but will feed on plants.

In those marked c.V., the tables show that the bugs prefer plants to aphides, both in the observations of the feeding habits and in the comparative length of life. A few have been observed to feed on aphides. These species are chiefly vegetarian, but will feed on aphides.

In those marked V., the tables show that the bugs are definitely vegetarian.

In those marked C.V., the specimens showed no definite preference for either plants or aphides.

Some species are marked c. ; in these there is insufficient evidence to show clearly the feeding habits, but the observations indicate that some individuals are capable of feeding on aphides.

At least one specimen of the species marked with an asterisk has been identified by Mr. W. E. China.

Species marked with a dagger are not recorded for the county of Buckinghamshire in E. A. Butler, 1923, 'A Biology of the British Hemiptera-Heteroptera,' London.

Pentatomidae.

1. **Podops inuncta** Fabr.

Date collected : August 4th, 1934.

Plant on which found : At the base of stems of *Urtica dioica* L.

Number collected : One.

Food given: *Urtica dioica* L.
Length of life: Six days.

2. **Sehirus bicolor** L. (V.)

Date collected: April 27th, May 4th, 1933.
Plants on which found: *Alliaria officinalis* Andrz., *Lychnis dioica* L., *Heracleum sphondylium* L., *Rubus fruticosus* L., *Rumex* sp.

No.	Food given.	Observations.	Days of life.
1—4.	*Alliaria officinalis* Andrz.		27, 33, 36, 38.
5.	*Lychnis dioica* L.		26.
6.	*Heracleum sphondylium* L.		38.
7.	*Rubus fruticosus* L.		31.
8.	*Rumex* sp.		28.

3. †**Picromerus bidens** L. (C.)

Date collected: August 15th, 1933; September 11th, 12th, 1934.
Plants on which found: *Cochlearia armoracia* L., *Convolvulus sepium* L.

No.	Food given.	Observations.	Days of life.
1.	*Convolvulus sepium* L.		10.
2.	*Cochlearia armoracia* L.		8
3—7.	Lepidopterous larvae.	Fed whenever fresh larvae were given.	15, 19, 19, 18, 20.

While in the tube, one specimen laid a batch of thirty-seven eggs. I collected another batch of twenty-eight, on the base of a dead grass stem, September 14th, 1934.

4. **Acanthosoma haemorrhoidale** L.

Date collected: September 12th, 1934.
Plant on which found: Oak.
Number collected: One.
Food given: Oak.
Length of life: Ten days.

5. **Elasmostethus griseus** L. (V.)

Date collected: July 20th, 1934.
Plant on which found: *Rubus fruticosus* L.

No.	Food given.	Observations.	Days of life.
1—4.	*Rubus fruticosus* L.		15, 14, 14, 15.
5—8.	*Pieris rapae* L. larvae.	Not seen to feed.	8, 8, 9, 8.

LYGAEIDAE.

6. **Nysius thymi** Wolff.

Date collected: September 11th, 1934.
Plant on which found: On the ground of flax-plots.

No.	Food given.	Observations.	Days of life.
1.	*Linum usitatissimum* L.		11.
2—3.	*Capsella bursa-pastoris* Medik.		Still living Oct. 2nd.
4—5.	*Aphis rumicis* L.	Not seen to feed.	7, 8.

7. ***Drymus sylvaticus** Fabr.

Date collected: August 4th, 1933; May 11th, 24th, 1934.
Plant on which found: The base of grass stems.

No.	Food given.	Observations.	Days of life.
1—2.	Grass.		2, 1.
3.	Aphides from rose.	Not seen to feed.	1.

8. ***Scolopostethus affinis** Schill.

Date collected: April 29th, 1933.
Plant on which found: Under a plank.
Number collected: Five.

REDUVIIDAE.

9. **Nabis lativentris** Boh.

Date collected: August 4th, 1933; September 15th, 1934.
Plant on which found: Base of grass stem, dry stem of *Rumex* sp.
Number collected: Two.

10. **Nabis major** Cost. (C.)

Date collected: July 14th, 1933.
Plant on which found: Roots of grass.

No.	Food given.	Observations.	Days of life.
1.	Aphides.	Fed.	13.
	Sawfly larvae.	Fed.	
2.	Aphides.	Fed July 17th.	21.
	Coccinellid larva.	Not seen to feed.	
	Syrphid larva.	Fed July 17th.	
	Sawfly larva.	Fed July 19th.	
	Mamestra brassicae L. larva.	Fed August 2nd and 3rd.	

3.	Aphides.	Fed July 17th.	22.
	Coccinellid larva.	Not seen to feed.	
	Syrphid larva.	Fed July 17th.	
	Sawfly larva.	Fed July 18th.	
	Pieris rapae L. larva.	Not seen to feed.	
	Mamestra brassicae L. larva.	Fed August 1st.	

11.*†**Nabis boops** Schiödte, macropterous form.

Date collected: July 30th, 1934.
Plant on which found: Roots of grass.
Number collected: One.

12. **Nabis limbatus** Dahlb.

Date collected: September 24th, 1934.
Plant on which found: Roots of grass.
Number collected: Two.

13. **Nabis ferus** L.

Date collected: September 26th, 1934.
Plant on which found: Roots of grass.
Number collected: One.

14. **Nabis rugosus** L.

Date collected: May 5th, 1933.
Plant on which found: Roots of grass.

No.	Food given.	Observations.	Days of life.
1—2.	Grass.		9, 14.

ANTHOCORIDAE.

15. ***Anthocoris nemoralis** Fabr. (c.)

Date collected: May 7th, 1933.
Plant on which found: *Crataegus oxyacantha* L.

No.	Food given.	Observations.	Days of life.
1.	Aphides.	Fed May 11th.	9.
	Day-old *Pieris rapae* L. larva.	Fed May 16th, 17th.	

16. †**Anthocoris sarothamni** D. and S. (c.)

Date collected: May 10th, 14th, 1934.
Plant on which found: *Cytisus scoparius* Link.

No.	Food given.	Observations.	Days of life.
1.	*Cheimatobia brumata* L. larva.	Fed May 11th.	3.
2.	*Cheimatobia brumata* L. larva.	Fed May 11th.	3.
3.	Aphides from apple.	Fed May 14th.	1.

17. ***Anthocoris nemorum** L. (c.)

Date collected: May 8th, 1934.
Plant on which found: *Crataegus oxyacantha* L.

No.	Food given.	Observations.	Days of life.
1.	Aphides from apple.	Fed May 8th.	3.
	Tortricid larva from apple.	Not seen to feed.	
2.	Aphides from apple.	Fed May 8th.	5.
	Tortricid larva from apple.	Not seen to feed.	
3.	Aphides from apple.	Fed May 9th.	3.
	Tortricid larva from apple.	Not seen to feed.	
4.	Aphides from apple.	Fed May 8th.	4.
	Tortricid larva from apple.	Not seen to feed.	

18.*†**Triphleps minuta** L. (c.)

Date collected: May 8th, June 15th, 1934.
Plant on which found: *Salix alba* L., *Erigeron* sp.

No.	Food given.	Observations.	Days of life.
1.	Aphides from apple.	Fed May 8th.	4.
	Tortricid larva.	Not seen to feed.	
2.	Aphides from rose.	Fed June 21st.	11.
3.	Aphides from rose.	Fed June 22nd, 28th.	17.

Capsidae.

19. **Miris calcaratus** Fall.

Date collected: May 3rd, November 6th, 1933.
Plant on which found: Roots of grass.

No.	Food given.	Observations.	Days of life.
1—2.	Grass.		10, 8.
3.	Aphides from rose.	Not seen to feed.	5.

20. ***Stenodema laevigatum** L. (V.)

Date collected: May 3rd, 4th, 7th, 17th, 24th, 1933.
Plant on which found: Grass.

No.	Food given.	Observations.	Days of life.
1—5.	Grass.		8, 6, 8, 10, 8.
6—10.	Aphides.	Not seen to feed.	3, 4, 2, 3, 1.

If any of the specimens given aphides were resting, and an Aphidid happened to walk on to them, they would shake their bodies violently to free themselves. They would then walk to another part of the tube, where the same thing was usually repeated. This would continue until the bugs fell to the sand exhausted. They would continue to struggle feebly for some time, and then die.

21. **Miris holsatus** Fabr.

Date collected: June 23rd, 1933.
Plant on which found: Grass.

No.	Food given.	Observations.	Days of life.
1—2.	Grass.		7, 9.
3—4.	Aphides from rose.	Not seen to feed.	4, 2.

22. ***Notostira erratica** L.

Date collected: June 23rd, 26th, 1934.
Plant on which found: Grass.

No.	Food given.	Observations.	Days of life.
1.	Grass.		8.
2.	Aphides from rose.	Not seen to feed.	2.

23. **Leptopterna dolobrata** L.

Date collected: June 7th, 9th, 1933.
Plant on which found: *Plantago lanceolata* L., grass.

No.	Food given.	Observations.	Days of life.
1.	Grass.		9.
2.	Aphides from rose.	Not seen to feed.	4.

24. ***Phytocoris tiliae** Fabr. (c.)

Date collected: July 21st, 26th, 30th, 1933; September 12th, 1933.
Plant on which found: Oak.

No.	Food given.	Observations.	Days of life.
1—3.	Oak.		4, 1, 3.
4.	Aphides from rose.	Not seen to feed.	2.
5.	Aphides from rose.	Fed July 26th.	8.
6.	Aphides from rose.	Fed July 24th.	6.
	Pieris rapae L. larvae.	Not seen to feed.	

25. **Phytocoris ulmi** L. (c.)

Date collected: June 9th, July 11th, 12th, 21st, 1933.
Plant on which found: *Ribes nigrum* L., *Abies* sp., oak.

No.	Food given.	Observations.	Days of life.
1.	*Ribes nigrum* L.		9.
2.	Oak.		4.
3.	Aphides from rose.	Fed July 14th.	
	Coccinellid larva.	Not seen to feed.	
4.	Aphides from rose.	Fed July 21st.	2.

26. †**Megacoelum infusum** H. S. (c.)

Date collected: July 21st, 26th, 1933.
Plant on which found: Oak, willow.

No.	Food given.	Observations.	Days of life.
1.	Aphides from rose.	Fed July 23rd.	5.
	Pieris rapae L. larva.	Not seen to feed.	
2.	Aphides from rose.	Not seen to feed.	2.

27. **Calocoris norvegicus** Reut. (V.)

Date collected: June 7th, 14th, 21st, 22nd, 27th, 1933; June 18th, 27th, 1934.
Plant on which found: *Carduus arvensis* Robs., *Urtica dioica* L., *Heracleum sphondylium* L.

No.	Food given.	Observations.	Days of life.
1—5.	Thistle.		5, 5, 8, 7, 8.
6—7.	*Mamestra brassicae* L. larva.	Not seen to feed.	2, 4.
8—10.	Aphides from thistle.	Not seen to feed.	2, 7, 1.
11.	Aphides from thistle.	Not seen to feed.	4.
12.	Aphides from thistle.	Not seen to feed.	3.

28. †**Calocoris sexguttatus** Fabr.

Date collected: June 6th, 1933.
Plant on which found: Oak.
Number collected: One.

29. †**Pycnopterna striata** L. (c.)

Date collected: May 25th, 31st, 1934.
Plant on which found: Oak.

No.	Food given.	Observations.	Days of life.
1—4.	Oak.		12, 5, 8, 4.
5.	Aphides from currant.	Fed May 31st.	8.
6.	Aphides from currant.	Not seen to feed.	8.
7.	Aphides from currant.	Fed May 28th, 29th.	5.

30. **Stenotus binotatus** Fabr. (C.V.)

Date collected: June 23rd, 1933; June 19th, 1934.
Plant on which found: Hazel, grass.

No.	Food given.	Observations.	Days of life.
1—4.	Grass.		2, 5, 3, 6.
5—8.	Aphides from rose.	Not seen to feed.	3, 5, 2, 6.
9.	Aphides from rose.	Fed June 25th.	8.

31. **Plesiocoris rugicollis** Fall.

Date collected: June 16th, 27th, 1933.
Plant on which found: Willow.

No.	Food given.	Observations.	Days of life.
1.	*Salix* sp.		5.
2.	Aphides from *Salix* sp.	Not seen to feed.	4.
3.	Aphides from thistle.	Not seen to feed.	1.
4.	*Mamestra brassicae* L. larva.	Not seen to feed.	1.

32. ***Lygus pabulinus** L. (c.)

Date collected: June 9th, 15th, 1934.
Plant on which found: *Ribes nigrum* L.

No.	Food given.	Observations.	Days of life.
1.	*Ribes nigrum* L.		7.
2.	Aphides from currant.	Fed June 10th, 11th.	2.
3.	Aphides from *Rumex* sp.	Not seen to feed.	2.

33. ***Lygus contaminatus** Fall. (c.)

Date collected: June 12th, 16th, 1933; June 19th, 22nd, 1934.
Plant on which found: *Corylus avellana* L., *Betula alba* L., *Salix* sp., *Rubus* sp., and grass.

No.	Food given.	Observations.	Days of life.
1.	*Rubus* sp.		6.
2.	*Salix* sp.		2.
3.	Grass.		1.
4—7.	Hazel.		8, 6, 8, 8.
8—12.	Hazel.		9, 3, 8, 3, 3.
13—16.	Aphides from rose.	Not seen to feed.	2, 2, 2, 6.
17—21.	Aphides from rose.	Not seen to feed.	3, 6, 6, 3, 6.
22.	Aphides from rose.	Fed June 28th.	15.

34. **Lygus lucorum** Mey.

Date collected: May 22nd, 24th, 1933; June 9th, 1933.
Plant on which found: *Ribes nigrum* L., *Salix* sp.

No.	Food given.	Observations.	Days of life.
1.	*Salix* sp.		5.
2—3.	Currant.		7, 4.
4.	Aphides from rose.	Not seen to feed.	6.
5.	Aphides from rose.	Not seen to feed.	2.

35. **Lygus pratensis** L. (c.)

Date collected: June 30th, 1933; September 10th, 1934.
Plant on which found: *Urtica dioica* L., *Linum usitatissimum* L.

No.	Food given.	Observations.	Days of life.
1—3.	*Linum usitatissimum* L.		7, 4, 4.
4—6.	Aphides from rose.	Not seen to feed.	5, 3, 4.
7.	Aphides from thistle.	Fed July 1st, 5th.	9.

36. ***Lygus rubricatus** Fall. (c.)

Date collected: July 7th, 12th, 1933; July 5th, 12th, 1934.
Plant on which found: *Abies* sp.

No.	Food given.	Observations.	Days of life.
1—3.	*Abies* sp.		2, 4, 8.
4—6.	*Abies* sp.		8, 4, 5.
7—10.	Aphides from dock.	Not seen to feed.	7, 2, 2, 2.
11—14.	Aphides from dock.	Not seen to feed.	6, 4, 1, 5.
15.	Aphides from thistle.	Not seen to feed.	3.
16.	Aphides from dock.	Fed September 9th.	5.

37. **Lygus cervinus** H. S.

Date collected: September 12th, 1934.
Plant on which found: *Hedera helix* L.
Number collected: Two.

38. **Lygus pastinacae** Fall. (c.)

Date collected: June 26th, July 3rd, 1934.
Plant on which found: *Heracleum sphondylium* L.

No.	Food given.	Observations.	Days of life.
1.	*Heracleum sphondylium* L.		10.
2.	Aphides from rose.	Fed June 28th.	4.
3—4.	Aphides from rose.	Not seen to feed.	4, 3.

39. †**Poeciloscytus unifasciatus** Fabr.

Date collected: July 4th, 1933; July 3rd, 1934.
Plant on which found: *Galium verum* L.

No.	Food given.	Observations.	Days of life.
1.	*Galium verum* L.		6.
2.	Aphides from *Galium* sp.	Not seen to feed.	1.
3—5.	Aphides from dock.	Not seen to feed.	3, 4, 1.

40. **Polymerus nigritus** Fall. (V.)

Date collected: July 4th, 1933; July 3rd, 1934.
Plant on which found: *Galium verum* L.

No.	Food given.	Observations.	Days of life.
1.	*Galium verum* L.		10.
2.	Aphides from *Galium* sp.	Not seen to feed.	1.
3.	Aphides from thistle.	Not seen to feed.	1.
4—6.	Aphides from dock.	Not seen to feed.	1, 1, 3.

A Hymenopterous larva emerged from one specimen, but unfortunately it died before becoming adult.

41. ***Camptobrochis lutescens** Schill. (C.v.)

Date collected: May 7th, 22nd, 1933; June 2nd, July, 28th, 1933; May 1st, 4th, 25th, 29th, 1934; June 29th, 1934.
Plant on which found: *Pinus sylvestris* L., *Crataegus oxyacantha* L., hazel, oak.

No.	Food given.	Observations.	Days of life.
1—2.	Oak.		4, 14.
3.	Hazel.		3.
4—8.	Oak.		2, 2, 8, 8, 4.
9.	Aphides from hazel.	Fed July 29th, 31st.	8.
	Mamestra brassicae L. larva.	Fed August 1st, 3rd.	
10.	Aphides from hazel.	Fed July 28th.	8.
	Mamestra brassicae L. larva.	Fed August 1st.	

11.	Aphides from hazel.	Fed July 28th.	3.
	Mamestra brassicae L. larva.	Not seen to feed.	
12.	Aphides from birch.	Fed May 2nd.	10.
	Aphides from apple.	Fed May 8th.	
	Cheimatobia brumata L. larva.	Fed May 5th.	
13.	*Cheimatobia brumata* L. larva.	Fed May 5th, 6th, 7th.	6.
14.	Aphides from rose.	Fed May 28th, June 8th, 15th, 18th.	26.
15.	Aphides from rose.	Fed May 28th, 29th, June 4th.	14.
16.	Aphides from rose.	Fed May 29th.	10.
17.	Aphides from rose.	Fed May 31st.	10.
18.	Aphides from rose.	Fed May 29th, 30th, 31st, June 4th, 8th, 11th, 18th.	30.

42. ***Liocoris tripustulatus** Fabr. (C.V.)

Date collected: May 24th, 29th, 1933; June 16th, 19th, 30th, 1933; July 3rd, 6th, 21st, 1933.

Plant on which found: *Urtica dioica* L.

No.	Food given.	Observations.	Days of life.
1—5.	*Urtica dioica* L.		4, 5, 8, 5, 3.
6—8.	Aphides from thistle.	Not seen to feed.	2, 3, 2.
9.	Aphides from thistle.	Fed July 4th, 6th.	6.
10.	Aphides from thistle.	Fed July 9th, 10th.	5.
11.	Aphides from thistle.	Fed July 22nd.	7.
12.	Aphides from thistle.	Fed July 24th.	4.
	Pieris rapae L. larva.	Fed July 26th.	

43. **Deraeocoris ruber** L. (C.)

Date collected: July 4th, 6th, 10th, 1933.

Plant on which found: Oak, birch, hazel, thistle.

No.	Food given.	Observations.	Days of life.
1.	Syrphid larva.	Fed July 6th.	6.
	Coccinellid larva.	Fed July 8th.	
2.	Syrphid larva.	Fed July 10th.	11.
3.	Lepidopterous larva.	Fed July 10th.	11.
4.	Large Syrphid larva.	Fed July 10th, 14th.	4.
5.	Large Coccinellid larva.	Not seen to feed.	13.
	Large dead Coccinellid larva.	Fed July 11th.	
	Aphides from rose.	Fed July 15th, 17th.	
6.	Coccinellid larva.	Not seen to feed.	13.
	Aphides from rose.	Fed July 12th.	
7.	Aphides from thistle.	Fed July 4th, 7th, 21st.	19.
	Sawfly larva.	Fed July 17th, 19th.	
8.	Aphides from thistle.	Fed July 4th, 8th, 11th.	15.
9.	Aphides from thistle.	Fed July 4th.	5.
10.	Aphides from thistle.	Fed July 4th, 13th.	17.

I reared one specimen from its third instar to maturity, on a diet consisting solely of aphides from rose.

44. **Capsus ater** L. (V.)
Date collected: June 21st, 22nd, 1933; June 7th, 11th, 15th, 1934.
Plant on which found: *Urtica dioica* L., grass.

No.	Food given.	Observations.	Days of life.
1—4.	Grass.		16, 10, 12, 10.
5.	Aphides from *Salix* sp.	Not seen to feed.	5.
6.	Aphides from nettle.	Not seen to feed.	1.
7—11.	Aphides from rose.	Not seen to feed.	9, 4, 2, 9, 13.

45. **Dicyphus epilobii** Reut.
Date collected: July 7th, 1934.
Plant on which found: *Epilobium hirsutum* L.
Number collected: One.

46. †**Dicyphus errans** Wolff. (c.)
Date collected: June 30th, July 2nd, 1934.
Plant on which found: *Calendula officinalis* L.

No.	Food given.	Observations.	Days of life.
1—3.	*Calendula officinalis* L.		12, 4, 7.
4—5.	Aphides from dock.	Not seen to feed.	5, 7.
6.	Aphides from dock.	Fed July 3rd.	7.

47. **Dicyphus pallidicornis** Fieb.
Date collected: June 17th, 1934.
Plant on which found: *Digitalis purpurea* L.

No.	Food given.	Observations.	Days of life.
1—3.	*Digitalis purpurea* L.		10, 15, 13.

48. **Campyloneura virgula** H. S.
Date collected: July 11th, 1933.
Plant on which found: *Crataegus oxyacantha* L.

No.	Food given.	Observations.	Days of life.
1—3.	Aphides from thistle.	Not seen to feed.	3, 5, 4.

49. †**Pilophorus perplexus** D. & S. (c.)
Date collected: July 11th, 1933.
Plant on which found: Oak.

No.	Food given.	Observations.	Days of life.
1.	Aphides from thistle.	Fed July 11th, 14th.	8.
2.	Aphides from thistle.	Fed July 12th, 17th, 23rd.	13.

50. **Cyllocoris histrionicus** L. (c.)

Date collected : June 12th, 1934.
Plant on which found : Oak.

No.	Food given.	Observations.	Days of life.
1—2.	Oak.		5, 3.
3—4.	Aphides from currant.	Not seen to feed.	5, 5.
5.	Aphides from currant.	Fed June 15th, 18th.	7.

51. †**Cyllocoris flavonotatus** Boh. (C.)

Date collected : May 22nd, 1933 ; May 25th, 28th, 1934.
Plant on which found : Oak.

No.	Food given.	Observations.	Days of life.
1—6.	Oak.		4, 3, 5, 3, 3, 5.
7—11.	Oak.		5, 2, 3, 5, 2.
12—13.	Aphides from rose.	Not seen to feed.	3, 7.
14.	Aphides from rose.	Fed May 28th.	9.
15.	Aphides from rose.	Fed May 28th, 29th.	5.
16.	Aphides from rose.	Fed May 30th, 31st, June 3rd.	11.
17.	Aphides from rose.	Fed May 28th.	7.
18.	Aphides from rose.	Fed May 31st.	7.
19.	Aphides from rose.	Fed May 29th, June 4th.	8.
20.	Aphides from rose.	Fed May 29th, 30th, June 4th.	8.
21.	Aphides from rose.	Fed May 30th.	6.
22.	Aphides from rose.	Fed May 28th, 31st.	7.
23.	*Pieris rapae* L. larva.	Fed May 22nd, 24th, 26th.	4.
	Aphides from rose.	Fed May 25th.	

52. ***Blepharidopterous** (**Aëtorrhinus**) **angulatus** Fall.

Date collected : July 17th, 1933.
Plant on which found : Hazel.

No.	Food given.	Observations.	Days of life.
1.	Aphides from thistle.	Not seen to feed.	3.

53. †**Cyrtorrhinus pygmaeus** Zett.

Date collected: June 27th, July 14th, 1933; July 7th, 1934.
Plant on which found: Grass.

No.	Food given.	Observations.	Days of life.
1.	Grass.		10.
2—3.	Aphides from thistle.	Not seen to feed.	2, 4.

54. ***Orthotylus marginalis** Reut.

Date collected: June 9th, 1934.
Plant on which found: *Ribes nigrum* L.

No.	Food given.	Observations.	Days of life.
1.	*Ribes nigrum* L.		5.

55. †**Orthotylus nassatus** Fabr.

Date collected: June 16th, 1933.
Plant on which found: *Salix* sp.

No.	Food given.	Observations.	Days of life.
1.	*Salix* sp.		8.

56. †**Orthotylus ochrotrichus** Fieb. (c.)

Date collected: June 16th, 1933.
Plant on which found: Hazel.

No.	Food given.	Observations.	Days of life.
1.	Aphides from rose.	Fed June 18th.	8.

57. **Heterotoma meriopterum** Scop. (c.)

Date collected: July 3rd, 6th, 11th.
Plant on which found: Hazel, oak, apple, grass.

No.	Food given.	Observations.	Days of life.
1.	Aphides from rose.	Fed July 6th.	5.
2.	Aphides from rose.	Fed July 14th.	8.
3.	Aphides from thistle.	Fed July 11th.	3.
4.	Aphides from thistle.	Fed July 3rd, 6th, 15th, 18th.	18.

58. †**Amblytylus brevicollis** Fieb.
Date collected: June 19th, 1934.
Plant on which found: Grass.

No.	Food given.	Observations.	Days of life.
1.	Aphides from rose.	Not seen to feed.	9.

59. †**Harpocera thoracica** Fall.
Date collected: May 5th, June 6th, 1933; May 15th, 22nd, 1934.
Plant on which found: Oak.

No.	Food given.	Observations.	Days of life.
1—4.	Oak.		3, 6, 4, 6.
5.	*Aphis rumicis* L.	Not seen to feed.	9.
6.	*Cheimatobia brumata* L.	Not seen to feed.	3.
	Aphis rumicis L.	Not seen to feed.	
7—8.	Aphides from rose.	Not seen to feed.	3, 4.

60.*†**Phylus palliceps** Fieb. (c.)
Date collected: June 16th, 1933; June 12th, 26th, 1934.
Plant on which found: Oak.

No.	Food given.	Observations.	Days of life.
1.	Oak.		3.
2.	Aphides from *Salix* sp.	Fed June 16th.	3.
3.	Aphides from currant.	Fed June 12th.	8.
4.	Aphides from rose.	Fed June 28th.	5.
5—6.	Aphides from rose.	Not seen to feed.	2, 2.

61. **Phylus melanocephalus** L. (C.V.)
Date collected: June 6th, 16th, 1933; June 12th, 1934.
Plant on which found: Oak.

No.	Food given.	Observations.	Days of life.
1—3.	Oak.		5, 8, 10.
4—6.	Oak.		5, 5, 1.
7—8.	Aphides from thistle.	Not seen to feed.	2, 4.
9.	Aphides from thistle.	Fed June 15th.	10.
10—11.	Aphides from currant.	Not seen to feed.	5, 6.

62.*†**Phylus coryli** L. (C.v.)
Date collected: June 16th, 20th, 22nd, 23rd, 1933; July 18th, 1933; June 22nd, 26th, 1934.
Plant on which found: *Heracleum sphondylium* L., *Urtica dioica* L., hazel, oak.

No.	Food given.	Observations.	Days of life.
1—3.	Hazel.		3, 6, 6.
4.	Aphides from rose.	Fed June 25th.	6.
5.	Aphides from rose.	Fed June 28th.	5.
6.	Aphides from rose.	Fed June 27th.	5.
7.	Aphides from rose.	Fed June 23rd, 28th.	9.
8.	Aphides from rose.	Fed June 26th, 27th, 28th.	12.
9.	Aphides from thistle.	Not seen to feed.	1.
10.	Aphides from *Salix* sp.	Fed June 19th.	8.
11.	Aphides from *Salix* sp.	Fed June 17th.	5.
12—13.	Aphides from apple.	Not seen to feed.	5, 2.

63. **Psallus ambiguus** Fall.
Date collected: June 26th, 1933.
Plant on which found: Hazel, apple.

No.	Food given.	Observations.	Days of life.
1.	Hazel.		12.
2.	Apple.		7.
3.	Aphides from apple.	Not seen to feed.	3.

64. ***Psallus variabilis** Fall. (C.V.)
Date collected: June 7th, 1934.
Plant on which found: Oak.

No.	Food given.	Observations.	Days of life.
1—4.	Oak.		12, 3, 6, 10.
5.	Aphides from rose.	Fed June 11th.	6.
6.	Aphides from rose.	Fed June 8th.	5.
7.	Aphides from rose.	Fed June 9th, 12th.	10.
8.	Aphides from rose.	Fed June 10th, 11th.	10.
9—10.	Aphides from rose.	Not seen to feed.	2, 3.

65. ***Psallus varians** H. S. (c.V.)
Date collected: June 6th, 16th, 1933; June 7th, 1934.
Plant on which found: Oak, apple.

No.	Food given.	Observations.	Days of life.
1—4.	Oak.		3, 5, 5, 6.
5—8.	Oak.		6, 8, 7, 5.
9—12.	Oak.		6, 10. 7, 8.
13—16.	Oak.		6, 12, 3, 12.
17—19.	Aphides from rose.	Not seen to feed.	3, 5, 4.
20—21.	Aphides from rose.	Not seen to feed.	4, 3.
22.	Aphides from rose.	Fed June 11th.	6.
23.	*Aphis rumicis* L.	Not seen to feed.	9.
24.	*Aphis rumicis* L.	Fed June 8th, 12th.	12.

66. ***Psallus roseus** Fabr.

Date collected : July 17th, 18th, 1933 ; July 30th, 1934.
Plant on which found : Hazel, *Salix* sp.

No.	Food given.	Observations.	Days of life.
1—2.	*Salix* sp.		7, 8.
3—4.	Aphides from thistle.	Not seen to feed.	7, 3.

67. ***Atractotomus magnicornis** Fall. (c.)

Date collected : June 23rd, 30th, 1933 ; July 5th, 1934.
Plant on which found : *Urtica dioica* L., *Abies* sp., hazel.

No.	Food given.	Observations.	Days of life.
1—3.	*Abies* sp.		5, 5, 2.
4—6.	Aphides from dock.	Not seen to feed.	1, 1, 2.
7.	Aphides from dock.	Fed July 9th.	8.

68. ***Plagiognathus chrysanthemi** Wolff. (c.)

Date collected : July 3rd, 1933 ; June 26th, July 5th, 1934.
Plant on which found : *Heracleum sphondylium* L.

No.	Food given.	Observations.	Days of life.
1.	*Abies* sp.		5.
2.	Aphides from thistle.	Fed on dead Aphid, July 4th.	2.
3.	Aphides from rose.	Not seen to feed.	2.
4—6.	Aphides from dock.	Not seen to feed.	1, 4, 3.

69. ***Plagiognathus arbustorum** Fabr. (c.)

Date collected : June 21st, 22nd, 26th, 27th, 1933 ; July 3rd, 1933 ; June 18th, 1934.
Plant on which found : *Heracleum sphondylium* L., *Urtica dioica* L., thistle, grass.

No.	Food given.	Observations.	Days of life.
1—2.	Thistle.		7, 3.
3.	Aphides from thistle.	Fed June 22nd, 25th, 26th.	10.
4.	Aphides from thistle.	Fed June 28th.	5.
5.	Aphides from thistle.	Fed June 22nd.	2.
6.	Aphides from thistle.	Fed June 30th.	5.
7.	Aphides from thistle.	Fed June 22nd.	3.
8.	Aphides from thistle.	Not seen to feed.	2.
9—10.	Aphides from rose.	Not seen to feed.	4, 2.
11.	Aphides from rose.	Fed June 22nd.	2.

70.*†**Sthenarus roseri** H. S. (c.)

Date collected: June 16th, 22nd, 30th, 1933.
Plant on which found: *Urtica dioica* L., *Salix* sp., hazel.

No.	Food given.	Observations.	Days of life.
1.	Aphides from *Salix* sp.	Fed June 19th.	6.
2.	Aphides from *Salix* sp.	Fed June 18th.	7.
3.	Aphides from *Salix* sp.	Fed June 19th.	7.
4.	Aphides from apple.	Not seen to feed.	2.
5—7.	Aphides from thistle.	Not seen to feed.	2, 2, 4.

The following is a list of records of all the other species of Heteroptera collected in the Field Station since 1929:—

1. *Verlusia quadrata* Fabr., ♂, collected flying, December 4th, 1930.
2. *Myrmus miriformis* Fall., collected sweeping, August 22nd, 1933.
3. †*Heterogaster urticae* Fabr., collected at light, December 18th, 1929, and on nettles, September 1st, 1934.
4. †*Stygnocoris rusticus* Fall., ♂, ♀, collected on shrubs, October 3rd, 1931.
5. *Stygnocoris pedestris* Fall., ♀, collected under *Deschampsia caespitosa* Beauv., August 12th, 1931.
6. *Peritrechus sylvestris* Fabr., collected from straw from old duck coop, March 22nd, 1929.
7. *Scolopostethus thomsoni* Reut., collected May 4th, 1929.
8. *Berytus minor* H.S., collected on cabbage plots, May 17th, 1934.
9. †*Monanthia ampliata* H.S., collected at roots of grass, April 22nd, 1933.
10. †*Cimex* (*Oeciacus*) *hirundinis* Jen., collected in sparrow's nest in martin's old nest, June 9th, 1931.
11. *Triphleps nigra* Wolff., ♂, collected on *Convolvulus sepium* L., August 18th, 1931, and another on *Sisymbrium officinale* Scop., August 8th, 1931.
12. †*Triphleps majuscula* Reut., two collected on nettles, September 1st, 1934.
13. *Lyctocoris campestris* Fabr., ♂, collected in ditch, June 6th, 1933.
14. †*Xylocoris ater* Duf., collected on cabbage, September 7th, 1934.
15. †*Phytocoris reuteri* Saund., ♀, collected on currant, August 11th, 1931.
16. *Adelphocoris lineolatus* Goeze, ♀, collected in ditch, July 12th, 1929, and on shrubs, October 3rd, 1931.

17. *Lygus kalmii* L., ♂, collected on *Daucus,* August 16th, 1933.
18. *Monalocoris filicis* L., collected on *Sisymbrium officinale* Scop., August 25th, 1932.
19. *Orthotylus diaphanus* Kb., ♀, collected on *Salix alba* L., August 12th, 1931.
20. *Onychumenus decolor* Fall., ♀, collected sweeping, August 7th, 1931.

In the above tables, thirty-four species out of the seventy collected have been observed to feed on aphides; of these, four are definitely carnivorous (*Picromerus bidens* L., *Nabis major* Cost., *Deraeocoris ruber* L., and *Cyllocoris flavonotatus* Boh.). Two species will feed on plants, but prefer aphides (*Camptobrochis lutescens* Schill., and *Phylus coryli* L.). One species will feed on aphides, but prefers plants (*Psallus varians* H.S.). Twenty-seven species show that some specimens will feed on aphides, but further experiments are necessary to show which foods they prefer (*Anthocoris nemoralis* Fabr., *Anthocoris sarothamni* D. & S., *Anthocoris nemorum* L., *Triphleps minuta* L., *Phytocoris tiliae* Fabr., *Phytocoris ulmi* L., *Megacoelum infusum* H.S., *Pycnopterna striata* L., *Stenotus binotatus* Fabr., *Lygus pabulinus* L., *Lygus contaminatus* Fall., *Lygus pratensis* L., *Lygus rubricatus* Fall., *Lygus pastinacae* Fall., *Liocoris tripustulatus* Fabr., *Dicyphus errans* Wolff., *Filophorus perplexus* D. & S., *Cyllocoris histrionicus* L., *Orthotylus ochrotrichus* Fieb., *Heterotoma meriopterum* Scop., *Phylus palliceps* Fieb., *Phylus melanocephalus* L., *Psallus variabilis* Fall., *Atractotomus magnicornis* Fall., *Plagiognathus chrysanthemi* Wolff., *Plagiognathus arbustorum* Fabr., and *Sthenarus roseri* H.S.). However, it has been found that four of these species show no preference for aphides or plants (*Stenotus binotatus* Fabr., *Liocoris tripustulatus* Fabr., *Phylus melanocephalus* L., and *Psallus variabilis* Fall.). Six species are definitely vegetarians (*Sehirus bicolor* L., *Elasmostethus griseus* L., *Stenodema laevigatum* L., *Calocoris norvegicus* Reut., *Polymerus nigritus* Fall., and *Capsus ater* L.).

No conclusion as to the foods of some species could be obtained, as an insufficient number of specimens was collected for the experiments.

It will be seen that in the tables the average length of life of the specimens is short. This is probably due to the following three causes :—

First. Condensation of moisture in the tubes has been difficult to control, especially in the tubes in which there were leaves. The bugs were trapped in the moisture, and al-

though they were transferred to other tubes, death usually followed in a few days.

Secondly. Under moist conditions the growth of moulds appeared on the sand, and difficulty was experienced in keeping the bugs free from infection.

Thirdly. Owing to the lack of time, it was found to be impossible to breed the bugs in order to procure specimens of known age. The age of the bugs used was not known.

This may help to explain the variations in the length of life of different individuals of the same species kept under apparently similar conditions.

Apart from the feeding habits of the bugs, in *Liocoris tripustulatus* Fabr. there seem to be two, if not three, distinct colour phases.

First. Those specimens collected in April and May have all the light markings orange red, except a small pale yellow spot on the apex of the scutellum.

Secondly. Those specimens collected at the beginning of July have all the light markings pale yellow.

Thirdly. Those specimens collected at the end of July have all the light markings pale yellow, and in the elytra the corium is yellowish, semi-transparent except for a black band across the apex.

When the second (pale yellow) phase appears, the first phase (specimens with orange red markings) disappears. This also happens when the third phase appears.

Two specimens of *Sehirus bicolor* L. laid clusters of shiny yellow eggs on the sand. Each cluster consisted of from twenty to thirty eggs, which gradually turned to a pink colour before hatching. They hatched in 22 and 24 days respectively. The habits of the female bug can be compared with those of the Pentatomid *Elasmostethus griseus* L., which shows elementary maternal care. *Sehirus* broods over the eggs before they hatch, searches for them when they are removed from the tubes, and continues to brood over them when they are returned. After the eggs hatch, the young nymphs cluster round the female. If the parent is removed, the nymphs scatter over the leaf as if searching for the female bug. When the bug is returned the nymphs once more cluster round. The young nymphs are never noticed to feed, and it is thought that they are unable to, without the assistance of the female bug. When the female was removed from the tube, the nymphs died within two or three days. Unfortunately none of the nymphs reached maturity. It is believed that this was because the adults died before the nymphs were able to look after themselves.

THE TRICHOPTERA OF THE OXFORD DISTRICT.

By the Rev. Prof. L. W. Grensted, D.D., F.R.E.S.,
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(From the Hope Department, University Museum, Oxford.)

In 'The natural history of the Oxford district,' a handbook prepared for the meeting of the British Association at Oxford in 1926, Mr. W. J. Lucas gave a brief list of local Trichoptera. The area covered was understood to be that within a radius of seven miles from Oxford, marked out roughly by Woodstock, Eynsham, Abingdon, and Islip. He was only able to record eighteen species, and, as he says, such a list is obviously 'very unsatisfactory' for a district so well watered. Actually the district is not so good for collecting as might appear, since the water consists almost entirely of two slow and considerable rivers, the Cherwell and the Thames, with the streams and wide ditches into which the latter is in part divided. The canal does not provide any different type of habitat. There are only one or two smaller and more rapid streams, flowing down the slopes above Hinksey and beyond Headington. The lake at Blenheim comes just within the area and provides the only records of Hydroptilids. The following list is perhaps worth publishing as typical of a district of this type. It is based entirely upon records which have been verified by Mr. M. E. Mosely and Mr. D. E. Kimmins, and is the result mainly of my own collecting. I am also indebted to Messrs. A. H. Hamm (A.H.H.), J. E. Collins (J.E.C.), and F. J. Killington (F.J.K.) for letting me see their captures. Unfortunately, many of the specimens in the Hope Department have no data, and I have only been able to obtain one or two local records from that source. I have placed Lucas' records (W.J.L.) in lifted commas in the list which follows.

Phryganeidae.

Phryganea grandis L.—'Common on Magdalen Bridge and elsewhere' (W.J.L.); Magdalen Bridge, 19.vi.1929, 13.vii.1932; Parks, 27.v.1934; R. Thames, 18.v.1934, 10.vi.1934.

P. striata L.—'Oxford' (W.J.L.); Magdalen Bridge (*in cop.*), 4.vi.1929; R. Thames, 29.v.1929, 6 and 9.vi.1929, 25.v.1933, 9.vi.1933, 18.v.1934; Parks, 22.v.1934.

LIMNOPHILIDAE.

Colpotaulius incisus Curt.—'The Parks, the Museum, and Iffley' (W.J.L.); R. Thames above Godstow, 1.vi.1901 (A.H.H.); Iffley, 23.v.1908 (A.H.H.).

Grammotaulius atomarius F.—'Shotover' (W.J.L.); Shotover, 6.v.1916 (A.H.H.); R. Thames, 16.v.1927; Bagley Wood, 5.v.1928 (A.H.H.); Oxford, 26.v.1932 (F.J.K.).

Glyphotaelius pellucidus Retz.—'Coldharbour, near Oxford' (W.J.L.); Oxford, 31.v.1907 (A.H.H.); Oxford, 26.v.1932; Bagley Wood, 22.v.1933 (A.H.H.); Parks, 10.vi.1934.

Limnophilus rhombicus L.—'Oxford' (W.J.L.); Magdalen Bridge, 5 and 8.vi.1929, 23.v.1932, 7.vii.1932.

L. flavicornis F.—R. Thames, 22.ix.1929.

L. lunatus Curt.—'Riverside near Iffley and Port Meadow stream' (W.J.L.); University College, 12.ix.1930; Oxford, 25.x.1932.

L. politus McL.—R. Thames near Iffley, 8.ix.1899 (A.H.H.). I have also seen specimens taken near Woodeaton, but have been quite unable to find this species myself. I doubt whether it is permanently resident in the district.

L. vittatus F.—'Magdalen Bridge and elsewhere' (W.J.L.); Hogley Bog, Cowley, 2.x.1926 (A.H.H.).

L. auricula Curt.—Common over the whole district in May. Many records (A.H.H.). My own dates are: University College, 9.v.1927; Magdalen Bridge, 21.v.1927; Wolvercote, 15.v.1928. Also in October: University College, 14.x.1927; Wootton, 3.x.1933. This species comes to light.

L. sparsus Curt.—'The Parks and Headington Wick' (W.J.L.); Headington, 13.vi.1908 (A.H.H.); Parks, 19.vi.1914, 25.v.1916 (A.H.H.); Cowley, 2.vi.1928 (A.H.H.); R. Thames, 25.viii.1933; Wootton, 3.x.1933.

L. fuscicornis Ramb.—R. Cherwell, 23.v.1932 (F.J.K.).

Anabolia nervosa Curt.—This species is abundant every year along the rivers from mid-September to mid-October. My dates range from September 19th to October 13th.

Stenophylax stellatus Curt.—Magdalen Bridge, 5.ix.1932; Iffley, 24.ix.1932.

S. vibex Curt.—Clarendon Buildings, 14.iv.1928 (A.H.H.).

S. permistus McL.—'The Museum, The Parks, and Headington Common' (W.J.L.); The Museum, 11.iv.1912, 1.v.1925, 24.iv.1930, 9.vi.1931 (A.H.H.); Headington, 12.v.1915

(A.H.H.); Parks, 2.viii.1915, 5.v.1917 (A.H.H.); University College, 6.v.1927, 7.v.1927, 28.iv.1930.

Micropterna lateralis Steph.—Cowley, 30.v.1919, 26.vi.1930 (A.H.H.). This and the two preceding species have mainly been taken at light.

Halesus radiatus Curt.—Abundant every year from late September until late November along the R. Thames. My dates range from October 19th to November 22nd.

H. digitatus Schr.—'The Parks and Magdalen Bridge' (W.J.L.). This record seems certainly to be an error for the preceding abundant species. Cowley, x.1933 (A.H.H.). This single record is confirmed by my taking the species by the little stream at Wootton, 28.x.1933 and 2.xi.1933, a very typical locality.

Chaetopteryx villosa F.—R. Thames, 22.x.1928. Also at Wootton, 2 and 3.xi.1933.

SERICOSTOMATIDAE.

Sericostoma personatum Spence.—'The Parks at Mesopotamia, Iffley, and Magdalen Bridge' (W.J.L.). I have, curiously enough, been unable to find this characteristic species and to confirm the record.

Notidobia ciliaris L.—Abundant by the rivers in May. My dates all lie between May 5th and May 23rd.

Goëra pilosa F.—'Iffley' (W.J.L.); Iffley, 23.v.1908 (A.H.H.); R. Thames, 24.v.1933, 9.vi.1933.

Brachycentrus subnubilus Curt.—Magdalen Bridge, 22.iv.1916 (A.H.H.); Museum, 25.v.1926 (A.H.H.); Oxford, 26.v.1932 (F.J.K.).

LEPTOCERIDAE.

Leptocerus nigronervosus Retz.—R. Thames, 25.v.1928; 19 and 20.v.1934.

L. annulicornis Steph.—R. Cherwell, 9.vi.1933.

L. aterrimus Steph.—'Mesopotamia' (W.J.L.). Abundant in June and July throughout the district. My dates range from June 6th and July 12th.

L. cinereus Curt.—R. Cherwell, 9.vii.1932, 6.vi.1934.

L. dissimilis Steph.—'Magdalen Bridge' (W.J.L.); Magdalen Bridge, 4.vii.1907 (A.H.H.), and 19.vii.1932; High Street, Oxford, 1.vii.1930.

Mystacides nigra L.—'River near Kennington and Port Meadow stream' (W.J.L.). Abundant along the rivers, especially

in the Parks, throughout the summer. Dates from May 26th to July 13th.

M. azurea L.—'Magdalen Bridge' (W.J.L.). Abundant along the rivers, June to September. Dates recorded from May 26th to September 10th.

The var. *albifrons* Moseley is common with the type form.

M. longicornis L.—Yarnton, 31.vii.1933 (J.E.C.).

MOLANNIDAE.

Beraea pullata Curt.—Two females from Hogley Bog, 1915 (A.H.H.), are probably of this species, but are not in sufficiently good condition for certain determination.

B. maurus Curt.—Hinksey Hill, 17 and 19.vi.1934.

Molanna angustata Curt.—Common along the rivers all the summer. My dates range from May 20th to August 1st.

HYDROPSYCHIDAE.

Hydropsyche pellucidula Curt.—Summertown (at light), 31.v.1932 (J.E.C.).

H. angustipennis Curt.—Canal, Oxford, 24.v.1928.

H. guttata Pict.—R. Thames, 16.v.1927, 22.v.1930.

PSYCHOMYIDAE.

Tinodes waeneri L.—'Riverside near Iffley' (W.J.L.); R. Thames, 22.v.1930, 19 and 20.v.1934; Canal, 8.vi.1934.

Lype phaeopa Steph.—Abundant by the river throughout the summer. My dates range from May 20th to September 11th.

POLYCENTROPIDAE.

Neureclipsis bimaculata L.—R. Thames near gas-works, 7.vii.1932, 1.viii.1933, 15.vi.1934. Occurs regularly in this locality, probably coming from the wide and still dyke close by, which closely resembles its ordinary habitats by the reedy margins of lakes. Not otherwise known from the Thames.

Plectrocnemia conspersa Curt.—Hogley Bog, 11.ix.1915 (A.H.H.).

Polycentropus flavomaculatus Pict.—R. Thames, 16.v.1927, 9.vi.1929, 16 and 24.ix.1932, 15.vi.1934.

Cyrnus trimaculatus Curt.—Abundant all the summer by the rivers. Dates from May 10th to September 10th. In May,

1934, a unicolorous golden variety was common with the type, occurring both in the Parks and at Iffley (see M. E. Mosely, 1934).

Hydroptilidae.

Oxyethira costalis Curt.—In enormous numbers on the bridge, Blenheim Lake, 14 and 16.v.1934.

O. simplex Ris.—Blenheim Lake, 16 and 20.v.1934.

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BOMBUS MUSCORUM (Linnaeus) AND *B. SMITHIANUS* White (Hym.).

By O. W. Richards, M.A., D.Sc., F.R.E.S.

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1. Acknowledgements.

B. muscorum Linnaeus and *B. smithianus* White are two rather uncommon, or at least very local, humble bees whose distribution raises some interesting problems. It is difficult for a single individual to obtain very much material of such species, and this study has only been made possible by the kind help of a number of Hymenopterists who have lent or given me material. It gives me great pleasure to acknowledge the help received in this way from Mr. R. B. Benson (British Museum), Prof. G. D. H. Carpenter (Hope Dept., Oxford University Museum), Dr. Runar Forsius (material from Finland and also a map of the distribution of *B. smithianus* in that country), Mr. H. M. Hallett (Welsh material), Dr. H. Hedicke (German material and advice as to nomenclature), Mr. G. J. Kerrich (Museum of Zoology, Cambridge), Dr. W. B. R. Laidlaw (Scottish material), Dr. J. H. Macdunnough (Dept. Agriculture, Ottawa, specimens from the Sladen coll.), Mr. L. R. Natvig (Zoologisk Museum, Oslo), Mr. V. B. Popov (Academy of Sciences, Leningrad), Dr. A. Roman (remarks on Linnaeus' type of *Apis muscorum*), Mr. A. W. Stelfox (Irish material, especially of *B. smithianus allenellus* Stelfox). I am also indebted to Dr. R. C. L. Perkins for some valuable suggestions in correspondence.

2. The type of Apis muscorum Linnaeus (1758).

Linnaeus first referred to his *Apis muscorum* in his 'Fauna Sueciae' (1746, p. 305, No. 1017) where his description is as follows: 'Apis hirsuta fulva; abdomine flavo. Suecis Moss Humbla. Habitat sub Hypnis et muscis aliis in pratis frequens, parum mellificans.' The first valid description for nomenclatorial

purposes is in the 'Systema Naturae' (10th ed., 1758, p. 579, No. 32). It runs as follows: 'A. hirsuta fulva, abdomine flavo. *Fn. suec.* 1017. . . *Habitat sub* Musco *terrestri.*'

A so-called type of *Apis muscorum* exists in the Linnean collection at Burlington House, where I was able to examine it owing to the kindness of the late Dr. Waterston. The specimen is a female of *B. humilis* Illiger (=*helferanus* Seidl=*solstitialis* Panzer). This is in agreement with information received from Dr. A. Roman that *Bombus muscorum* of authors does not occur in the parts of Sweden where Linnaeus collected.

On the other hand, it would be a great inconvenience to cease to use the name *muscorum* for the species to which that name has been applied consistently for the last thirty years. Again, Linnaeus' collection has been so much disturbed in the past that there is by no means complete certainty that the so-called type is the original specimen on which *Apis muscorum* was based. Herr Dr. H. Hedicke, in correspondence, has suggested to me that Linnaeus' name, '*Apis muscorum,*' was originally meant to cover all the brown, surface-nesting species (viz. *muscorum, agrorum* Fabr. and *humilis* Ill.). A single type-specimen could not possibly represent what he meant by *muscorum*. Although the reference to Fauna Suecica suggests that he had the bee he collected in Sweden specially in his mind, there is nothing in the 1758 description that strictly limits *Apis muscorum* to this species.

On the grounds, therefore, mainly of convenience, but also because there is always some doubt as to whether specimens in the so-called Linnean collection really represent Linnean types, I propose to continue to use the name *Bombus muscorum* (Linnaeus) for the species which is universally known by that name at the present time.

3. The separation of Bombus muscorum (Linnaeus) and B. smithianus White.

B. muscorum (Linnaeus) and *B. smithianus* White are two very closely allied species, the latter being frequently regarded as a variety of the former. Popov (1930) gives a character in the shape of the male eighth sternite by which he maintains that they can be separated. I have examined the eighth sternites of a number of males of each species and find so much variation in the shape that I am unable to place any reliance on the character given by Popov.

On the other hand, *B. smithianus* can always be recognised because the thoracic pleura, ventral surface and legs are entirely or mainly black haired, while the mesonotal hairs are deeper reddish-brown. For zoogeographical reasons it is convenient to regard these forms as species and they are, in any case, as dis-

tinct as *B. terrestris* Linn. and *B. lucorum* Linn. Their ranges do not overlap as much as in the latter pair of species, but new data published in the present paper show that there is at least some overlap in western Ross-shire.

While *B. smithianus* is always easily recognised, this is by no means the case with the females of *B. muscorum*. The male can always be recognised with certainty by means of the male genitalia, which have been figured by numerous authors. The female may be separated from *B. agrorum* by the absence of any black hairs from the dorsal surface of the thorax or abdomen. In that species there are always distinct patches of black hairs at the sides of at least some of the tergites. This criterion needs careful application in the Scottish Highlands where the race *B. agrorum septentrionalis* Vogt (a pale haired form) occurs. In *B. agrorum*, further, the hairs are longer and more uneven, the malar space is a little longer, and the furrow between the tubercles of the labrum is distinctly more narrowed anteriorly.

The separation of *B. muscorum* from *B. humilis* Illiger (=*solstitialis* Panzer, *helferanus* Seidl) is much more difficult. (The males, as before, are easily separable by means of the genitalia.) There appear to be no constant structural differences. *B. humilis* often has some black bristles above the bases of the forewings, but in British specimens the mesonotum is often entirely yellow haired. The following colour differences, which are difficult to appreciate in the absence of ample material for comparison, have to be relied on. In *B. muscorum*, the hairs of the abdomen are rather paler yellow, and the darker brownish hair-bands of the second and third tergites are much less evident. The mesonotal hairs often have a more or less distinctly reddish tint, contrasting with the paler yellow hairs of the collar and on the scutellum.

I have some large females of *B. humilis* from western Cornwall which are slightly worn. I cannot distinguish these from *B. muscorum*, but none of the males captured at the same time belonged to that species. As *B. muscorum* and *B. humilis* have a rather different distribution, the difficulty is not often acute.

In the south of England, *B. muscorum* is mainly found in marshy districts, but is very local. This habitat preference does not seem to be maintained in Scotland or Ireland. *B. humilis* is not known from Scotland or Ireland (? north of Yorkshire). Although found in marshy places, it is also found commonly on agricultural land and on chalk-downs.

Owing partly to a misunderstanding and partly to an error, Popov (1930) gives a number of erroneous British records of *B. smithianus*. Up to the publication of Sladen's book (1912), *B. muscorum*, when recognised, was usually referred to as 'smithi-

anus.' Such records, however, mostly refer to *muscorum* and not to *smithianus* in the sense of most modern authors.

Popov has also supposed that there is a pale haired race of *smithianus* which resembles *muscorum* in everything but size, hair-length and structure of male eighth sternite. I have already stated that I place no weight in the character of the eighth sternite. The supposed pale haired race of *B. smithianus* I believe to be founded entirely on various specimens of *B. muscorum*.

Of Popov's British records, only the following refer to true *smithianus*: Shetland, Hebrides, Scilly Isles, Alderney and Dover (1 ☿).

4. Variation in B. muscorum (Linnaeus).

B. muscorum (Linnaeus) : General Description.

Female. The hairs are pale ochreous-brown; those of the inner orbits narrowly, of the outer orbits broadly, a few in the neighbourhood of the ocelli, short hairs of the sixth tergite, short hairs preceding the apical fringes of the abdominal sternites, hairs of the four anterior tibiae and tarsi, of their femora in part and the short bristles among the corbicular hairs, black; mesonotum with reddish-brown hairs, usually fringed with paler ones in front and behind; second abdominal tergite with a rather indistinct band of browner hairs; wings rather dark fuscous; pubescence even. Length 16-18 mm.

Male. Resembles the female but the various pale haired areas are more similar in colour. The sixth tergite is pale haired and the seventh has black bristles. Length 15 mm.

The following subspecies may be recognised:—

1. **B. muscorum muscorum** (Linnaeus, 1758).

Female. Scutellum and collar not at all conspicuously fringed with paler hairs; fore coxae with pale hairs; middle femora pale haired except anteriorly and on a not very extensive dorsal patch on proximal half; hind femora black haired posteriorly; reflexed margins of first tergite with few or no, of second with few, black hairs; hairs rather short.

Following Vogt (1909), I am treating the north-eastern European form of the species as being the typical geographical race. I have examined sixteen females (kindly sent by Herr Dr. H. Hedicke) from various German localities, two females (Germany and Switzerland) in the B.M. coll.; there are, further, two workers and one male from Germany in the B.M. coll.

A male from St. Briac, Brittany (B.M. coll.) probably belongs to subsp. *sladeni* Vogt, but the distribution of races on the Continent is still quite uncertain. At present the only certain limits are the Channel in the west, the Alps in the south and the

Baltic in the north; I do not know the eastern limit, but I know that different races occur beyond the other boundaries. There are certainly further forms in Russia, but these have not been studied.

2. **B. muscorum pallidus** (Evans, 1900).

Female. Scutellum and collar usually rather conspicuously fringed with paler ochreous hairs; fore coxae considerably black haired; middle femora dorsally on basal half with many black hairs, a few also towards apex and ventrally, but posteriorly usually entirely, or almost entirely, pale haired (black hairs more numerous in specimens from the north-west); hind femora mainly black haired posteriorly and with some black hairs along the postero-dorsal margin and ventrally towards the apex; reflexed margins of tergites 1-2 usually with a few black hairs; brown hair-band of second tergite usually rather indistinct; size rather large; hairs rather long.

This is the characteristic Scotch and Irish form, found also on Mull and Skye (not on Orkney, Tiree, Coll, Outer Hebrides or Shetland). The southern boundary of its distribution is not yet known. I have examined twenty-five females, thirteen workers and four males from various Scottish localities and eight females, four workers and three males from various parts of Ireland (where the distribution is given by Stelfox, 1927, p. 271). One of the Irish males in the collection at the British Museum is covered with rather dark brown hairs (see mention by Saunders, 1902 *a*); no other similar males have been recorded and the specimen appears to be only an individual aberration.

Some of the Scottish females (three or four specimens) have almost as many black hairs on the middle femora as in *orcadensis* subsp. n., but this seems to be exceptional and perhaps more characteristic of specimens from the west coast.

3. **B. muscorum sladeni** Vogt (1911).

Female. Scutellum and collar on the average more pale fringed than *muscorum*, less so than *pallidus*; fore coxae usually pale haired; middle femora dorsally mainly black haired, very few or none ventrally and posteriorly; hind femora entirely pale haired, except for the short black hairs on the posterior surface; reflexed margins of abdominal tergites 1-2 usually with fewer black hairs in *pallidus*, often with none; abdomen and thorax rather less contrasting in colour, hairs rather shorter, brown band of tergite 2 rather more distinct than in *pallidus*; size about the same.

I would hardly have ventured to separate this race from *pallidus* if Dr. O. Vogt had not already described it. No doubt

long series from the north and south differ when put side by side, but the differences are small and the two series overlap.

I have examined the following specimens: — 1 ♂, 2 ☿☿, Lundy Is. (C. S. Elton), coll. O.W.R.; 1 ♀, Banwell, Somerset (Perkins), Oxford Mus.; 1 ♂, Welsh St. Donats, Glamorgan (Hallett); 1 ♀, Criccieth, and 1 ♀, Llanfairfechan (Hallett); 1 ☿, Sopwith, Wilts (Perkins), Cambridge Mus.; 1 ♂, Seaford, Sussex, Brit. Mus.; 4 ♂♂, Camber, Kent (Sladen), Brit. Mus.; 10 ♀♀, 20 ☿☿ and 1 ♂, Dover (Sladen), Ottawa Mus.; 1 ☿, Aldeburgh, Suffolk, Brit. Mus.; 1 ♀, 3 ☿☿ and 23 ♂♂, Mildenhall, Suffolk (Perkins), Cambridge Mus.; 3 ♀♀, 1 ♂, Wicken Fen, Cambs. (O.W.R. and Cambridge Mus.); 3 ♀♀, Wallasey, Cheshire, Oxford Mus.; 1 ♀, 'North of England,' Oxford Mus.

The northern limit of this race is not known; it is likely to intergrade completely with the race *pallidus*, possibly in Yorkshire or the Lake district. It is possible that it is also found in western France (see remarks under subsp. *muscorum*). Saunders (1902 *b*) records *B. muscorum* (probably this race) from the Channel Islands (Jersey and Guernsey).

4. **B. muscorum orcadensis subsp. n.**

Female. Scutellum and collar rather less pale and mesonotum rather paler haired than in *pallidus*; abdomen with hairs rather more ochreous and less sulphur-tinged; fore coxae mainly black haired; middle femora typically with many black hairs posteriorly as well as anteriorly (in only two out of nine females are the femora mainly pale haired posteriorly); hind femora with black hairs posteriorly and a few on the postero-dorsal margin; corbicle with rather more black hairs; reflexed margin of abdominal tergites 1-2 usually with more black hairs than in *pallidus*; size definitely a little larger than in *pallidus*, hairs a little longer.

The *male* and *worker* are not distinguishable from *pallidus*.

Type: Female, Mainland, Stennes, Orkney, 15 June, 1912 (E. G. B. Meade-Waldo), Brit. Mus. Paratypes: 10 ♀♀, 1 ☿, 1 ♂, Brit. Mus.; 1 ♀, Sladen coll., Ottawa Mus.; all from the Orkneys. I have seen specimens from Mainland, Sanday, Rousay and Westray.

Two females from southern Norway almost fall under this subspecies, but I have not been able to examine sufficient material to fix their status. In size and general colour they resemble *orcadensis*, but the middle femora are entirely or almost entirely pale haired: 1 ♀, Bergen, 2 June, 1872 (Schneider), and 1 ♀, Tøien (Siebke), both in the Oslo Museum.

5. **B. muscorum laevis** Vogt (1909).

Female. Very close to subsp. *muscorum,* but the hairs of the collar and scutellum do not at all contrast with those of the mesonotum, and those of the thorax contrast less with those of the abdomen; legs with hairs of similar colour; tergites 1-2 with no black hairs on the reflexed margins; brown hair-bands rather distinct on tergites 2-4; hairs very short and even; size rather small.

The only specimens I have examined which certainly belong to this race are 4 ♀♀, Jassian, and 1 ♂, 4 ☿☿, Ada-Bazar, Asia Minor, part of Dr. Vogt's original material, now in the Sladen collection at Ottawa. There are, however, a number of specimens in the British Museum collection which fall near *laevis*; it is possible that more adequate material would enable at least three more races, a Balkan, an Italian and a Franco-Spanish one, to be recognised. The specimens at present available are too few, and in some cases collections including both males and females from the same locality would be necessary to avoid confusion with *B. humilis* Ill.

The southern specimens examined are the following:—(1) Balkans: 3 ♀♀, 3 ☿☿, Albania (S. S. Saunders); 1 ♂, Bucarest (Montandon). (2) Italy: 2 ☿☿, Savona (G. Doria). (3) Franco-Spanish: 1 ♂, Bordeaux, and 1 ☿ with no data (Pérez); 3 ☿☿, Navalperal, Prov. Avila (Escalera). This last form is very like the subsp. *quasimuscorum* Vogt of *humilis*.

5. Variation in B. smithianus White.

1. **B. smithianus smithianus** White (1851).

Female. The hairs are black; vertical tuft largely yellow haired; a few short hairs above and below the antennae sometimes yellow (about one specimen in four); mesonotal hairs deep red-brown, the pale hairs usually extending down to the spiracles, round which is a moderately large area on which pale hairs are mixed with black; hairs of abdomen ochreous-yellow, sides of tergite 1 black mixed and a few hairs at base of disc of tergite 2 usually black; reflexed margins of tergites 2-5 black haired, or sometimes pale-mixed; black hairs rarely extending a little way on to the dorsal surface; tergite 6 with black bristles; sternites and legs black haired; hairs long and dense, moderately even; size large, length 18-20 mm.

Worker. Resembles the female, but there are fewer black hairs on the sides of abdominal tergites 1-2 which are often entirely pale haired; hairs of reflexed margins of tergites usually much pale-mixed; sternites often partly pale haired.

Male. Resembles the female, but the head has more pale hairs, those of the clypeus often entirely pale, or at least all the

shorter ones; mesopleuron more extensively pale haired, sometimes more than the anterior half entirely pale haired; tergites 1-2 with the reflexed margins black haired, 3-5 often pale haired; tergite 7, or 6 and 7, entirely or mainly black haired; sternites, especially the more anterior ones, considerably pale haired; legs black haired.

The species was described from the Shetlands; it also occurs in the typical form in the Outer Hebrides (Lewis), Tiree and Coll. I have examined the following specimens: 41 ♀♀, 26 ☿☿, 11 ♂♂, from various parts of the Shetlands; 8 ♀♀, 11 ☿☿, 5 ♂♂, Lewis (these have the mesonotal hairs rather darker red); 15 ♀♀, Tiree, and 3 ♀♀, Coll (Cambridge Mus.) (mesonotal hairs still darker; 1 ♀ from Coll has some black hairs intermixed on tergite 5); 1 ♀, Ross-shire, hills between Liennassie and the falls of Glomach, near Loch Duich, *ca.* 1,000 ft., 29 June, 1934. This last record is of some interest because it is the first definite proof of the occurrence of *smithianus* on the mainland of Scotland; *muscorum pallidus* was found a little lower down in the same valley, so the ranges of the two species probably overlap. I think that sufficient search would probably show that *smithianus* occurred on the hills in various parts of western Ross, Inverness and Skye. It is, of course, an assumption that *smithianus* is especially a hill-form on the mainland, but it is probable that if it was common at sea-level it would have been captured before now.

The form of *smithianus* found in south-western Norway is not racially separable according to the material at present available. I have examined the following specimens in the collection of the Oslo Mus.:—1 ♀, 1 ☿, Bergen (Schneider); 1 ♀, Lŭröen, Nordland (Esmark). According to Popov (1930) a form of *smithianus* also occurs on the Faroes; he also provides a map of its distribution in western Norway.

2. **B smithianus allenellus** Stelfox (1933).

Female. Differs from *smithianus* as follows: Fewer pale hairs on the head, tuft sometimes all black, the pale hairs in it brown rather than yellow; mesonotum darker red-brown; mesopleuron with few or no pale hairs intermixed in the region of the spiracle; tergite 1 black haired; tergite 2 with a large antero-discal lunule of black hairs, black hairs of reflexed margins of tergites more numerous and usually extending a little way on to the dorsal surface; tergite 5 sometimes with scattered black hairs; hairs a little shorter; length 17-19 mm.

Worker. Usually like the female, but some specimens darker; they may have a few black hairs scattered through the collar or even all over the mesonotum; tergite 5 sometimes almost entirely black haired; pale hairs of abdomen sometimes reddish-brown

rather than ochreous; more often, however (11 ☿☿), there is less black on tergite 2 than in the female.

Male. Resembles *smithianus,* but more black hairs on tergite 1 and sides of tergite 2 and on sternites.

W. Ireland, Aran Islands, July, 1932 and 1934 (Winckworth Allen). I have examined 6 ♀♀, 18 ☿☿ and 1 ♂ from Inishmore, Inisheer and Straw Is.

3*a*. **B. smithianus scyllonius subsp. n.**

Female. Resembles *smithianus* but more hairs on the head pale, including all the short hairs of the face and more of those on the vertex; mesonotum not quite so deep brown, scutellum a little pale fringed; pale hairs covering rather a larger area on the mesopleuron; fewer black and more pale hairs on the reflexed margins of abdominal tergites 3-5; a few pale hairs on the underside of the hind femora; sternites with some pale hairs mixed with the black ones of the apical fringe; hairs a little shorter; size a little smaller, length 17-19 mm.

Worker. Usually not separable from *smithianus,* but hind femora sometimes with some pale hairs beneath.

Male. Resembles *smithianus,* but pale hairs of mesopleuron more extensive.

Type: Female, St. Marys, Isles of Scilly, 10 Sept., 1904 (Yerbury), Brit. Mus. Other specimens examined: 1 ♀, St. Marys, 24 April, 1930 (O.W.R.); 7 ☿☿, St. Marys, July, 1925 and 1927; 1 ♂, July, 1925.

The race also occurs on the islands of Tresco and St. Martins, but I did not succeed in catching specimens there.

The existence of this race on the Scilly Isles has been known since the records of Bridgman (1879) and Yerbury (1904).

3*b*. **B. smithianus** subsp.

What may well prove to be a distinct race occurs on Alderney, Channel Islands. Luff (1900) and Saunders (1902 *b*) note that the form on this island is black haired beneath, unlike the *muscorum* on Guernsey and Jersey. Specimens have not been available for study.

Mention must also be made of a worker of *B. smithianus* stated by Perkins (1890) to have been captured near Dover by O. H. Latter. It is not quite clear from the context whether the pale form (=*muscorum*) or true *smithianus* is being alluded to, but in a letter Dr. Perkins tells me that this worker really did belong to *smithianus*. I can only suppose that it was a stray specimen blown from Alderney (about 180 miles) by a south-westerly gale. Sladen, in his extensive collecting in this district, never met with the species.

4. **B. smithianus bannitus** Popov (1930).

Female and *worker.* Resembles *smithianus,* but perhaps rather more hairs on the face pale; hairs of mesonotum less deep brown, more ochreous; mesopleuron usually with pale hairs on upper quarter; abdomen with fewer black hairs at base and on reflexed margins of tergites, but tergite 5 with more black hairs, sometimes they are quite numerous even on the disc; size perhaps a little smaller.

Male. With all the black haired parts of *smithianus* more or less invaded by pale hairs; only distinguished from *muscorum* by the largely black haired legs.

I have examined 1 ♀, Gov. Arkangel; 5 ☿☿, Gov. Tscherepov and Gov. Novgorod; 1 ♂, Gov. Tsherepovetz. All kindly sent by Mr. V. B. Popov.

The distribution of this form in Russia is given by Popov (1930). He applied the name *bannitus* originally to a few females and workers in which the fifth abdominal tergite was strongly invaded by black hairs; I think, however, the varietal name may well be transferred to the race.

5. **B. smithianus** subsp.

This form occurs in south-western Finland; I have not examined enough specimens to differentiate it satisfactorily.

Female. Resembles *smithianus,* but head with more pale hairs; mesopleuron perhaps with rather more pale hairs; abdomen with fewer black hairs at base and on reflexed margins of tergites; cilia of sternites partly pale haired; hind femora, and more rarely the corbicle, partly pale haired; size apparently rather small.

Male. Resembles *smithianus.*

Specimens examined: 1 ♀, 5 ☿☿, 1 ♂, from Nystad, Klåvskar Is. and Tvärminne, all in south-western Finland (kindly sent by Dr. R. Forsius).

This form seems to resemble *scyllonius* rather than *bannitus,* but it has more pale hairs on the legs; the hairs are longer; mesonotum perhaps a darker shade of brown.

According to Dr. Forsius, there are doubtful records of *smithianus* from the north of Finland; such records may be based on specimens of *bannitus.*

6. Discussion.

The distribution of *B. smithianus* in relation to that of *B. muscorum* raises a number of interesting zoo-geographical and evolutionary problems. In Europe, *B. smithianus* has a north-western distribution. It fringes the coasts of the British Isles,

Norway and Finland and only penetrates far inland in Russia. Such a '*fringing distribution,*' at least as regards the British Isles, is seen in the voles (*Microtus* and *Evotomys*) whose distribution is recorded by Barrett-Hamilton and Hinton (1913, 1914, 1915 and 1921). In these latter animals fossil remains provide indispensable evidence which enables one to define them as species which have retreated* before an invading fauna and have only survived in a fringe of western fastnesses. These fringing forms in *Evotomys* are allied to *E. nageri* Schinz, a species which occurs on the Continent chiefly in isolated elevated regions. In the British Isles representatives of this 'Rassenkreis' (see definition by Rensch, 1933) are found on the mainland as Pleistocene fossils, but at the present day only in Jersey, Skomer (Pembrokeshire), Mull and Raasay (Inner Hebrides).

The fringing forms of *Microtus* have a parallel history and evolution, but two species are involved. The 'Rassenkreis' of *M. arvalis* Pallas is found in Orkney and Guernsey, that of *M. agrestis* Linn. on the hills of the Scottish Highlands, on the Inner Hebrides (Arran, Gigha, Jura, Islay, Mull, ? Rum, Eigg, Muck and Skye) and the Outer Hebrides (not Lewis).

In both *Evotomys* and *Microtus,* the existing mainland form (corresponding to *B. muscorum*) is not found as a fossil till the very end of the Pleistocene, and it is presumed that they invaded England at this time and drove out the older and larger voles, except on the islands where they could not reach them.

The distribution of the *B. smithianus* 'Rassenkreis' (Shetland, Outer Hebrides, Tiree and Coll, Aran Islands, Scilly Isles and Alderney) exactly parallels that of the voles except that the latter are not now found in Ireland. In some cases the bees might in the past have been able to cross narrow channels which were already closed to the voles (e.g. Shetland). It is typical of such relic faunas to be local in their distribution (e.g. *Evotomys* on Skomer; *smithianus* on Scilly; *Evotomys*—Jersey, *Microtus*—Guernsey, *smithianus*—Alderney).

There are significant differences in the evolution of *Bombus*- and vole-races. The voles are probably almost completely isolated on islands and consequently there is a great tendency for separate races to develop on each island. This is well seen in *Microtus* on the Hebridean islands, where almost every island has a form at least slightly different. In *Bombus* this is scarcely possible and there are almost no visible differences between the forms of *B. smithianus* on Shetland and the Hebrides. At the same time the later invading form (*B. muscorum*) has been able to penetrate to the Orkneys and to most of the Inner Hebrides.

*'Retreat' is used metaphorically. The voles were once spread over the British Isles and have only become extinct on the mainland. The fringe is what is left and is not made up of individuals who were driven there.

It is possible that this accounts for the absence of *B. smithianus* on these islands. On the other hand, *B. muscorum* has not passed from Jersey and Guernsey to Alderney.

It may seem scarcely more than a metaphorical expression to speak of one species of humble bee being driven out by another; certainly no one has ever seen it actually taking place. But it is possible that there may be quite acute competition for nesting-sites, and it is interesting to note that these consist largely of the old nests of voles. It is significant that *B. muscorum* itself appears to be confined to peculiar habitats (*e.g.* fens) or to be a scarce species. On Lundy Island, however, where it is the only representative of the subgenus *Agrobombus*, it is common (according to specimens received from Mr. C. S. Elton). In the Channel Islands, Scotland and Ireland also, where *B. humilis* is absent and only *B. agrorum* present, *B. muscorum* is relatively common. As far as is known, no other species of *Agrobombus* occurs with the races of *B. smithianus* in this country, except in the newly-discovered locality in western Ross. It appears that a certain density of such allied species is possible and that in the absence of *B. agrorum* and *B. humilis*, *B. muscorum* or *B. smithianus* becomes common.

A distribution superficially rather similar to the 'fringing' type is seen in certain other species, viz. *Apodemus* species (wood mice) and in *Bombus jonellus* Kirby (Richards, 1933). This second type of distribution may be termed '*insular*.' In *Apodemus* the existing forms are all closely allied and similar species, or something scarcely distinguishable from them has long existed in this country. There is no fringe of relict species but rather a certain number of races along the northern periphery (Shetland, Inner and Outer Hebrides and St. Kilda) have become differentiated owing to isolation. It appears typical of the 'insular' type of distribution that there are no southern races. *Apodemus* is found on nearly all the southern islands in the same form as on the mainland. The same is true of *Bombus jonellus*, which has evolved races only on Shetland and the Outer Hebrides. *B. muscorum* itself has evolved a slightly differentiated race on the Orkneys. These northern island races show no very close relationship to the Norwegian forms as does *B. smithianus*.

The geological problem of the times at which the various islands were separated from the mainland is still largely unsolved and the detailed explanation of the geographical distribution of these animals is not yet possible. It would be very interesting if studies were made of other insects (e.g. Lepidoptera) which are known to have northern island races.

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PLATE V.

O. W. Richards del.

DISTRIBUTION OF BEES AND RODENTS.

Map of the distribution of 'fringing' forms of *Evotomys, Microtus* and *Bombus smithianus.*

E.n. = 'Rassenkreis' of *Evotomys nageri*; *M.a.* = 'Rassenkreis' of *Microtus arvalis*; *S.s.* = *B. smithianus smithianus*; *S.a.* = *B. smithianus allenellus*; *S.scy.* = *B. smithianus scyllonius*; *S.* = *B. smithianus* undetermined form; *Mu.or.* = *B. muscorum orcadensis.*

Distribution of the 'Rassenkreis' of *Microtus agrestis* outlined in red.

A PROVISIONAL LIST OF CORNISH INSECTS.

PART II.—DIPTERA (SYRPHIDAE, TACHINIDAE AND MUSCIDAE).

By the Rev. A. Thornley, M.A., F.L.S., F.R.E.S., F.R. Met. Soc.

The earlier records of Cornish Diptera are rather scanty, especially from the eastern part of the county. As far as I know the earliest printed list is that of C. W. Dale published in 1891, *Trans. Penzance Nat. Hist. Soc.* (N.S.), **3** : 262-6. This is a list of Diptera seen by himself and his father during several visits to Cornwall between the years 1864 to 1890. In his preface he mentions, incidentally, that Mr. F. Walker paid a visit to the Scilly Isles in September, 1871, and published a list of the flies observed in 1872, *Entomologist,* **6** : 4-5. Mr. Dale, however, does not tell us whether he included these Scilly records in his own list, which is extremely bare, neither the authority for the names, nor the place of capture of the specimens being given. Then followed in 1906, 'The Victoria County History of Cornwall.' * The portion of this important work dealing with the Insecta was edited by Dr. James Clark, M.A., A.R.C.S., Principal of the Central Technical Schools for Cornwall at Truro. In his Diptera list, Dr. Clark states that he has included all the species recorded in earlier lists, and, in addition, records by Col. J. W. Yerbury, Dr. G. C. Lamb of Cambridge, Mr. A. J. Tate of Truro, the Rev. J. Winsor Aubrey of Hale, Hants, the Rev. T. A. Marshall of Botus Fleming, and a valuable list of Scilly Diptera drawn up by Mr. F. Jenkinson. The remainder of the list, he tells us, consists chiefly of records provided by himself and his students. A difficulty with regard to these earlier lists arises from the fact that names are used for insects which at the time were considered to be single species, but which later studies have shown to consist of at least two or more species, *e.g.* the name *Sarcophaga carnaria* L. in these lists probably includes not only that species, but also *vicina* Vill., *teretirostris* Pand. and *aratrix* Pand.; and lastly the nomenclature is old, and numerous names are now out of use.

The following list contains records of about 440 species distributed as follows: 131 Syrphidae, 130 Tachinidae and 180 Muscidae. Although this seems a fairly large number, no one feels more than the author that much yet remains to be done before the county list can in any sense be considered complete. I am much indebted to Mr. J. E. Collin, F.R.E.S., for the deter-

* In the following lists references to this work are abbreviated to 'V.C.H.'

mination of all obscure species in the Syrphidae and the Muscidae; to Mr. C. J. Wainwright, F.R.E.S., for similar help in the Tachinidae; and to my old friend Prof. J. W. Carr, M.A., F.L.S., F.G.S., F.R.E.S., Emeritus Professor of Biology, University College, Nottingham, for a large number of records collected from the various entomological magazines. Finally, in view of the present confused state of the nomenclature I shall employ in this list the names at present in use in the best-known works on entomology at the present time (1934).

Syrphidae.

Of the 200 species of Syrphidae recorded for Great Britain by Mr. G. H. Verrall in his well-known book (1901, 'British Flies,' London, **8**), I have records of 131 records taken in the county, that is about 65 per cent.; but I have no doubt that with more systematic work this percentage will be much increased. Several interesting species have occurred, and I will only mention here *Chilosia mutabilis* Fln., *Platychirus sticticus* Mg., *Syrphus diaphanus* Zett., and a species of *Eristalis,* named by Mr. J. E. Collin *E. abusivus,* first discovered in Cornwall.

Merodon equestris F. is a great danger to the important bulb-growing industry of the county, while *Eumerus strigosus* Fln. and the recently recognised *E. tuberculatus* Rond. are also serious pests. The nomenclature of the species is in the main that used by Mr. Verrall (*op. cit.*).

Pargus tibialis Fln.—Recorded from most parts of the county. A single male of a variety with a flavous mark on the fourth dorsal segment of the abdomen, and named *sigillatus* by Curtis, was taken by me at Carbis Bay, 23.vii.33.

Pipizella virens F.—Common, and recorded from most parts of the county.

Genus **Pipiza.**—This genus is still in a state of some confusion, but the species in my Cornish collection are most probably **Pipiza austriaca** Mg. (=*lugubris* Verrall), **P. noctiluca** L. and **P. bimaculata** Mg. All these were taken in the Carbis district.

P. luteitarsis Zett.—Carbis Bay, 1 ♂, 14.v.34 (A.T.).

Cnemodon vitripennis Mg.— Evidently uncommon. 1 ♂, St. Mawes, 24.vi.26 (A.T.).

Orthoneura nobilis Fln.—Helston Dist., 1 ♀, 21.vii.31 (A.T.); Calenick, 1 ♀, 28.vii.34 (A.T.).

Liogaster splendida Mg.—A few examples at St. Ives, Carbis Bay, and Lelant Towans (A.T.).

L. metallina F.— Common. Recorded from most parts of the county.

Chrysogaster hirtella Lw.—Widely distributed and usually common in most parts of the county.

C. chalybeata Mg.—Recorded from St. Ives, Carbis Bay, Lelant, St. Erth, Helston and Looe (A.T.); Hayle, and near Gwinear Road Station (L. Parmenter).

C. solstitialis Fln.—St. Ives, Carbis Bay, Lelant, Truro Dist., Lostwithiel, Bodmin, St. Hilary, Porth Navas, Helston, Tintagel, Boscastle, Padstow, and Saltash in E. Cornwall.

C. virescens Lw.—Padstow (Dr. Lamb); Carbis Bay and Porth Navas (A.T.).

C. splendens Mg.—Common. Recorded from most parts of the county.

Chilosia antiqua Mg. (=*sparsa* Lw.).—Rather common. Recorded from E. Cornwall; partly as *C. sparsa* Lw., by the Rev. T. A. Marshall; St. Ives, Carbis Bay, and Lelant (A.T.).

C. scutellata Fln. — Uncommon. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Lanhydrock (Bodmin Dist.), 1 ♀, 15.vii.29 (A.T.); Lelant Downs, 1 ♀, 4.viii.34 (L. Parmenter).

C. pulchripes Lw. (=*pagana* Mg.).—Recorded from all districts with var. *floccosa* Verrall.

C. illustrata Harris.—Common. Recorded from all districts.

C. variabilis Pz.—Very common in all districts.

C. honesta Rnd.—Occurs sparingly. St. Ives, Lelant, Carbis Bay (A.T.).

C. intonsa Lw. — Padstow (Dr. Lamb); Wadebridge and Perranporth (Rollason); St. Ives, Carbis Bay, Lelant and Phillack Towans, Lamorna Cove and Kennack (Lizard Dist.) (A.T.).

C. grossa Fln.—Scarce. Truro, once in the Grammar School garden (Tate).

C. fraterna Mg.—Occurs sparingly. E. Cornwall (Rev. T. A. Marshall); St. Ives, Lelant, and Lamorna Cove (A.T.).

C. impressa Lw.—Rather common. Penzance (Verrall, 1901, 'Brit. Flies,' **8**: 245); Gurnard's Head, St. Ives, Carbis Bay, Lelant and St. Erth (A.T.); Kynance Cove (M.K.F.T.); Hayle (L. Parmenter).

C. albitarsis Mg.—Common in all districts.

C. vernalis Fln.—Common in all districts.

C. bergenstammi Beck.—A single example taken by me at St. Ives, 11.viii.26.

C. mutabilis Fln.—Uncommon. St. Ives, several examples; Lanhydrock, 1 ♀, 17.vii.29 (A.T.).

C. proxima Zett.—'Cornwall' (Verrall, 1901, 'Brit. Flies,' **8**: 258). Apparently uncommon though probably confused with large specimens of *vernalis* Fln. Carbis Bay, 1 ♀, May, 1932; Lanhydrock, 2 ♂♂ and 2 ♀♀, July, 1929

(A.T.). All these were kindly corroborated for me by Mr. J. E. Collin.

Platychirus manicatus Mg.—Common in all districts. SCILLY, Tresco, August, 1878, F. Norgate (1880, *Ent. Mon. Mag.*, **16**: 183).

P. peltatus Mg.—Occurs rather sparingly. St. Ives, Carbis Bay, Lelant, and St. Erth (A.T.); the lower Lynher River, E. Cornwall ('V.C.H.').

P. albimanus F.—The commonest species in all districts.

P. scutatus Mg.—Common in all districts.

P. clypeatus Mg.—Recorded from all districts.

P. angustatus Zett.—Not common. St. Ives, Carbis Bay, Truro Dist. (A.T.); St. Hilary, 1934 (A.T.).

P. discimanus Lw.—Recorded in the 'V.C.H.' from Liskeard, but no authority given.

P. immarginatus Zett.—Calenick (Truro Dist.), 1 ♂, 23.v.31 (A.T.); Lelant, 1 ♂, 19.v.33 (A.T.).

P. sticticus Mg.—Rare. St. Ives, 1 ♂, 24.viii.26 (A.T.); Calenick, 1 ♀, 26.vi.31 (A.T.).

Pyrophaena granditarsa Först.—Locally common in marshy places. St. Ives, St. Erth, Truro Dist., Padstow (A.T.).

P. rosarum F.—Apparently very local. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265). The 'V.C.H.' gives Kea (near Truro) and Marazion. Pencalenick and Idless (Truro Dist.), 1 ♀ from each locality in Aug., 1932 (A.T.).

Melanostoma ambiguum Fln.—St. Ives, 1 ♂, April, 1927, and 1 ♂ and 1 ♀, April and May, 1930 (A.T.); Carbis Bay, a few taken in April and May, 1928 and 1930, and a ♂ on February 1st, 1932 (A.T.); Hayle, 28.vii.34 (L. Parmenter).

M. mellinum L.—Common in all districts. Taken a few times in the month of November, even as late as the 24th, in Carbis Bay.

M. scalare F.—Nearly as common as *mellinum*. Melanic forms occur occasionally.

Xanthandrus comtus Harris.—Occurs sparingly and singly from August to October. Truro (Tate), Padstow (Dr. Lamb). SCILLY (J. H. Jenkinson).

Leucozona lucorum L.—Widely distributed, but never abundant. Porthonstock (Rollason); St. Ives, Carbis Bay, Lelant, St. Erth, Truro Dist. (A.T.).

Ischyrosyrphus glaucius L.—Widely distributed and locally common. Penzance (Verrall, 1901, 'Brit. Flies,' **8**: 323); Carnon Croft and Kea (Rollason); St. Ives, Carbis Bay, St. Erth, Lamorna Cove, and Bodmin Dist. (A.T.); Lelant Downs and Helston (L. Parmenter).

I. laternarius Müller.—Much less common than *glaucius*. Liskeard and Bishop's Wood, Truro (Rollason); Bodmin Dist., 3 examples at Lanhydrock, July, 1929, and 1 ♂ at Dunmere Wood, July, 1929 (A.T.).

Catabomba pyrastri L. —Common in all districts, but much more abundant some years than others. I have taken the female variety *unicolor* (Curt.) at St. Ives, Carbis Bay and Lelant (A.T.).

Didea fasciata Mcq.—'Several specimens taken at scabious on Kenwyn Hill, Truro, by Mr. Tate' ('V.C.H.'). This record, however, is queried and the suggestion made that the species might have been *intermedia* Lw.

Syrphus tricinctus Fln.—Not common. Truro Dist. (Tate); Carclew Woods (Rollason); St. Ives, 3 examples (A.T.); St. Hilary, 1 ♀ (M.K.F.T.).

S. venustus Mg.—Helston (Verrall, 1901, 'Brit. Flies,' **8**: 350); Launceston, Liskeard, Carnanton Woods, St. Columb ('V.C.H.'); Carbis Bay (A.T.).

S. lunulatus Mg.—Not common. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 264); St. Ives, once only (A.T.); Carbis Bay, 1 ♂, 24.v.34 (A.T.).

S. albostriatus Fln. — Rather common. W. Cornwall (C. W. Dale, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 264); St. Ives, Carbis Bay, Lelant, St. Erth, Lanhydrock Woods (A.T.); Helston Dist. and Hayle (L. Parmenter).

S. torvus O.-S.—Recorded chiefly from W. Cornwall where it is sometimes common. Padstow (Dr. Lamb); St. Ives, Carbis Bay, Lelant (A.T.). Scilly, March, 1902 (Jenkinson).

S. grossulariae Mg.—Nearly all my records of this local species are from W. Cornwall, where in places it has occurred freely. Penzance (Verrall, 1901, 'Brit. Flies,' **8**: 364); St. Ives, Carbis Bay, Lelant, St. Erth, Lanhydrock, Loe Pool, Helston (A.T.); Tressilian, near Truro (C. Nicholson).

S. ribesii L.—Common. Earliest date 13.iii.26, at St. Ives (A.T.). Scilly, captor and date not given ('V.C.H.').

S. vitripennis Mg.—Common and generally distributed.

S. diaphanus Zett.—The only records of this rare species are 1 ♂, 20.vii.29, in the Dunmere Woods, Bodmin Dist., and 1 ♀, 27.vi.31, at Calenick in the Truro Dist., both taken by myself.

S. nitidicollis Mg.—Uncommon. St. Ives, 1 ♂, 8.v.26, and 2 ♀♀, 28.vi.26; Carbis Bay, 1 ♂, 9.v.31; Lelant Estuary, 1 ♂, 18.v.31; all records by A.T.

S. latifasciatus Mcq.—Locally common. Malpas and Flushing ('V.C.H.'); Padstow (Dr. Lamb); St. Ives, Carbis Bay, Lelant Towans, Lamorna Cove, Hayle Towans and Truro Dist. (A.T.); Helston (L. Parmenter).

S. corollae F.—Very common in all districts.

S. luniger Mg.—Common in most districts from April to October. SCILLY, Tresco, March, 1902, Jenkinson (1904, *Ent. Mon. Mag.*, **40**: 156).

S. bifasciatus F.—Locally common in April and May, St. Ives, Carbis Bay, Lelant (A.T.); Truro (Tate).

S. balteatus De G.—Common and widely distributed. I took a male at Carbis Bay on 16.ii.32 and a female on 9.xi.32. Recorded also from SCILLY.

S. lasiophthalmus Zett.—Not uncommon in early spring. St. Ives, Carbis Bay, Lelant and Truro Dist. (A.T.).

S. umbellatarum F.—Occurs sparingly in W. Cornwall. Penzance Dist. (C.W. Dale, 1891, *Trans. Penzance Nat. Hist.*, N.S., **3**: 264); St. Ives, Carbis Bay, Lelant Towans, St. Erth, Truro Dist. (A.T.).

S. compositarum Verr.—The only record, 'Penzance' (Verrall, 1901, 'Brit. Flies,' **8**: 414).

S. auricollis Mg.—Not uncommon and widely distributed throughout the county, both variety *maculicornis* Zett. and *nigritibius* Rnd. occur frequently with the type. I have taken the species from the middle of March up to the end of October. A fresh female variety *nigritibius* was taken on 1st February, 1932 (A.T.). SCILLY, Tresco, March, 1902 (Jenkinson).

S. cinctus Fln.—Botus Fleming (Rev. T. A. Marshall in 'V.C.H.').

S. cinctellus Zett.—E. Cornwall (Rev. T. A. Marshall); St. Ives, Carbis Bay, Lelant, Trecrom, St. Hilary, St. Michael's Mount, Truro Dist., Bodmin Dist., Tintagel (A.T.).

Sphaerophoria scripta L.—Common and widely distributed, but chiefly the var. *scripta* L. I have also taken the var. *dispar* Lw. on the Lelant Towans; and a few approaching the var. *nigricoxa* Zett. at St. Ives, Carbis Bay, and Lelant, with one example of var. *strigata* Staeg. at Carbis Bay. The var. *scripta* L. has also been taken at Hayle and Helston and the var. *dispar* Lw. at Helston by L. Parmenter.

S. menthastri L.—Apparently as common and widely distributed as *scripta* L. Nearly all my specimens seem to be the var. *picta* Mg., the type form *menthastri* L. being rare.

S. flavicauda Zett.—St. Columb (Black, 'V.C.H.'); Helston, L. Parmenter.

Xanthogramma citrofasciatum De G.—Apparently local, but common where it occurs. St. Ives, Carbis Bay and Lamorna Cove; several also were taken at Tintagel during the month of June, 1933 (A.T.).

X. ornatum Mg.—Local, but widely distributed. Millook and Liskeard ('V.C.H.'); near Idless (Rollason); Padstow

(Dr. Lamb); St. Ives, Carbis Bay, Lamorna Cove, Bodmin Dist., Tintagel (A.T.); Phillack, Hayle (L. Parmenter).

Baccha obscuripennis Mg. and **elongata** F.—The distinction between these two species is very small. Both seem to occur commonly all over the county. While most of them seem to be *obscuripennis* I have a few which I take to be *elongata*.

Sphegina clunipes Fln.—'A single specimen at Cowrie Haven, Poundstock' ('V.C.H.'); two specimens at Carbis Bay on 21.v.28 and 17.v.33; two more at Lanhydrock, 8.ix.30; and one at St. Erth, 27.vi.33 (A.T.).

Ascia podagrica F.—Common and widely distributed; often seen at ivy bloom in September.

A. dispar Mg.—Pentillie, 2.v.1893 (Col. J. W. Yerbury, 1919, *Rep. Devons. Ass. Adv. Sci.*, **51**: 229); St. Erth, 3 specimens on 15.viii.27 and 4.vi.31 (A.T.).

Brachyopa bicolor Fln.—'Common on tree trunks in the cascade woods, Trebartha, May, 1902' ('V.C.H.'); St. Ives, 1 ♂, 17.v.26, and Lelant, 1 ♂, 18.v.31 (A.T.).

Rhingia campestris L.—Common in all districts.

Volucella inanis L.—Two specimens taken in Bishop's Wood, Truro, 26.vii.1902 (Tate, 'V.C.H.'); Tintagel, Aug., 1915 (C. W. Bracken, 1915, *Entomologist*, **48**: 285); N. Cornwall (A. S. Buckhurst, 1925, *Entomologist*, **58**: 304).

V. pellucens L.—Widely distributed and locally common.

V. inflata F.—Recorded from Cornwall in Verrall, 1901, 'Brit. Flies,' **8**: 489; also from Mount Edgcumbe (Rev. J. H. Adams).

V. bombylans L.—Recorded from all districts; var. *bombylans* L. and *plumata* De G. very common; var. *haemorrhoidalis* Zett. once only at St. Ives (A.T.).

Eristalis sepulchralis F.—Uncommon. Cawsand (C. W. Bracken); St. Ives, 1 ♀, 4.ix.29 and 1 ♀, 8.ix.34 (A.T.); Porth Gwarra, 1 ♂, 24.viii.34 (A.T.); Angarrack, St. Hilary and Marazion (L. Parmenter).

E. aeneus Scop.—Occurs sparingly on or near the coast, Newquay (C. W. Bracken); Padstow (Dr. C. G. Lamb); Helford River Dist. (H. W. Andrews); St. Ives, Carbis Bay, Lelant, Hayle Towans (A.T.). Dr. C. G. Lamb (1911, *Ent. Mon. Mag.*, **47**: 215) has a very interesting note upon the occurrence of the larva of this species in rock pools at the northern end of Constantine Bay (St. Merryn). SCILLY, Tresco (Col. J. W. Yerbury, 1904, *Ent. Mon. Mag.*, **40**: 154).

E. tenax L.—Very common, recorded from all districts. SCILLY, Tresco, 11.iv.04 (Col. J. W. Yerbury, 1904, *Ent. Mon. Mag.*, **40**: 154).

E. intricarius L.—Not uncommon. Recorded from all districts with var. *furvus* Verr. SCILLY, St. Marys, 9.iv.04 (Col. J. W. Yerbury, 1904, *Ent. Mon. Mag.*, **40**: 154).

E. arbustorum L.—Very common in all districts. SCILLY, taken March, 1902, by Jenkinson (1904, *Ent. Mon. Mag.*, **40**: 156).

E. abusivus Collin.—Marazion Marshes, May and June, 1914, 3 ♂♂ and 2 ♀♀, by the Hon. N. C. Rothschild; these specimens were discovered in the British Museum collections and recorded by Mr. R. L. Coe in 1934, *J. Soc. Brit. Ent.*, **1** (2) : 40. Also 1 ♀ between Hayle and St. Erth, 31.vii.34; 1 ♂, in Marazion Marsh, 31.vii.34; and 1 ♀, Carbis Bay, 4.viii.34 (all by L. Parmenter).

E. cryptarum F.—Looe ('V.C.H.'); Carnon Croft and Kea, 5.ix.1910 (Rollason).

E. pertinax Scop.—Common in all districts.

E. nemorum L.—Not uncommon. Launceston and Falmouth ('V.C.H.'); Padstow (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, St. Erth, Dunmere Woods and Bodmin Dist. (A.T.); Helston, St. Erth, Angarrack (L. Parmenter). SCILLY, St. Marys (Col. J. W. Yerbury, 1904, *Ent. Mon. Mag.*, **40**: 154).

E. horticola De G.—Common in most districts.

Myiatropa florea L.—Some years common. Recorded from all districts.

Helophilus trivittatus F.—Padstow (Dr. C. G. Lamb); Carnon Croft and Kea (Rollason); Truro (Tate); Mawgan (C. W. Bracken); Penzance, St. Ives, Lelant (A.T.).

H. hybridus Lw.—Bishop's Wood, Truro (Tate); St. Merryn Dist. (Dr. C. G. Lamb).

H. pendulus L.—Common in all districts.

H. versicolor F.—Budock Bottoms, Falmouth ('V.C.H.'); St. Erth, rather common some years (A.T.); Pencalenick, Truro Dist. (A.T.).

H. transfugus L.—Land's End and Marazion (Bailey); St. Erth, three examples (A.T.).

H. lunulatus Mg.—Land's End (Bailey). Common about Pentillie and Hessenford (Col. Yerbury).

H. lineatus F.—E. Cornwall (Rev. T. A. Marshall); Liskeard, Falmouth, Swanpool ('V.C.H.'); Looe (Adams); Marazion (L. Parmenter). SCILLY (Dr. C. G. Lamb in 'V.C.H.').

Merodon equestris F.—Common, and very often injurious to *Narcissus* and other bulbs. The var. *narcissi* F. seems common, but the var. *validus* Mg. is much less so.

Criorrhina ranunculi Pz.—Uncommon. Taken near Truro in April, 1909, by Rollason, who also later took 2 examples in Nansavallon Wood in April, 1910. Also recorded at laurel bloom in Mount Edgcumbe Park, near Picklecombe Fort

(Col. J .W. Yerbury, 1919, *Rep. Devons. Ass. Adv. Sci.*, **51** : 233).

C. berberina F.—Botus Fleming, June, 1897 (Rev. T. A. Marshall in 1897, *Ent. Mon. Mag.*, **33**: 150); St. Ives, 1 ♀, June, 1925 (M.K.F.T.); Tresillian (Truro), May, 1931 (C. Nicholson).

C. oxyacanthae Mg.—W. Cornwall (C. W. Dale, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Calenick Truro Dist., 2 examples, May, 1909 (Rollason); Bishop's Wood, Truro (Tate); Tresillian, September, 1933 (C. Nicholson).

C. floccosa Mg.—Bishop's Wood, common (Tate in 'V.C.H.'); Pentillie, 12th May, 1893 (Col. J. W. Yerbury, 1919, *Rep. Devons. Ass. Adv. Sci.*, **51** : 233); Carnanton Woods, Mawgan-in-Pyder (Dr. C. G. Lamb in 'V.C.H.'); Carbis Bay, Lelant, St. Erth, Calenick, Truro (A.T.).

Xylota segnis L.—Common. Recorded from all districts.

X. lenta Mg.—E. Cornwall (Rev. T. A. Marshall); near Idless, Truro, July, 1910 (Rollason); Looe (Ahams).

X. sylvarum L.—Launceston, Trevillis, Doublebois, Liskeard ('V.C.H.'); near Idless, July, 1919 (Rollason); Dunmere Woods (Bodmin), 2 examples, July, 1929 (A.T.).

Syritta pipiens L.—Very common, recorded from all districts.

Eumerus sabulonum Fln.—Penzance (Verrall, 1901, 'Brit. Flies,' **8**: 619); St. Ives, Lelant Towans, Mullion Cove, Tintagel, and Chapel Porth, St. Agnes (A.T.).

E. strigatus Fln.—Very common. Larva frequently found attacking bulbs.

E. tuberculatus Rnd.—Occurs along with *strigatus* with which it is often confused, and seems equally common. Recorded also as a pest of bulbs.

E. ornatus Mg.—Paul, near Penzance (W. E. Bailey, 'V.C.H.').

Chrysochlamys cuprea Scop.—Was taken by Tate in the Grammar School garden, Truro, in 1904-5, and by myself at St. Ives, Lelant and St. Erth.

Arctophila mussitans F.—W. Cornwall. Recorded as *Sericomyia superbiens* Müller by C. W. Dale (1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Truro, Kenwyn Hill, by Tate who took about a dozen on a patch of scabious ('V.C.H.'); N. Cornwall, by C. J. Wainwright (1891, *Entomologist*, **24**: 276); N. Cornwall, Coombe Valley, 1 specimen, June, 1912 (S. E. Hall).

Sericomyia borealis Fln.—Not uncommon and widely distributed. Bodmin Moor (F. W. Edwards, 1930, *Ent. Mon. Mag.*, **66**: 278); Truro Dist., 'plentiful' (Tate); Carnon Croft, Kea, and near Idless (Rollason); St. Ives, Carbis Bay, St. Erth, Helston, Calenick, Bossiney and Boscastle (A.T.).

Chrysotoxum cautum Harris.—Rather common. Bosvigo Wood, Truro (Tate) ; St. Ives, Carbis Bay, Lelant, Bodmin Dist., Port Navas (A.T.).

C. elegans Lw.—Padstow (Dr. C. G. Lamb) ; Kynance Cove, 1 ♀, June, 1926, and Carbis Bay, 1 ♂, July, 1930 (A.T.) ; Polzeath (Padstow Dist.), July, 1905 (A. E. Gibbs, F.L.S., 1906, *Entomologist,* **39**: 5).

C. festivum L.—Common. Padstow and St. Merryn Dist. (Dr. C. G. Lamb) ; Penpoll and Devoran (Rollason) ; St. Ives, Carbis Bay, Lelant, St. Erth, Bodmin Dist. (A.T.) ; Polzeath, July, 1905 (A. E. Gibbs, F.L.S., 1906, *Entomologist,* **39**: 5).

C. vernale Lw.—Penzance, 1 ♀, 13.vii.1871 (Verrall). This specimen was named by Loew himself for Mr. Verrall (*cf.* 1901, 'Brit. Flies,' **8**: 652).

C. bicinctum L.—Padstow (Dr. C. G. Lamb) ; near Idless, Truro (Rollason) ; St. Ives, Carbis Bay, Kynance Cove (A.T.).

C. octomaculatum Curt.—Penwethers, one example (Tate, 'V.C.H.').

Microdon mutabilis L.—Liskeard, 16.vi.1904 ('V.C.H.').

Tachinidae.

The list of Tachinidae in the 'V.C.H.' is a very short one, containing little over a dozen species. The list which follows contains about 130 out of 300 British species, and includes two which have been added recently to the British list as a result of specimens taken by me, *viz. Sarcophaga hirticrus* Pand. and *Ernestia connivens* Zett. The first of these has occurred quite commonly at times in my own district, but as yet only four examples of the *Ernestia* have been taken. *Exorista westermanni* Zett., a little-known species, occurs rather frequently in W. Cornwall. Amongst other rare species captured in the county may be mentioned *Wagneria latifrons* Zett., *Actia bicolor* Mcq., *Ocyptera brassicaria* F., *Sarcophaga sinuata* Mg., *Medoria anthracina* Mg. and *Erycia fatua* Mg. The county is rich in species of *Sarcophaga,* for no less than 20 out of the 28 mentioned in Mr. C. J. Wainwright's list (1928, *Trans. Ent. Soc. Lond.,* **76** : 139-254) have occurred recently. My best thanks are due to Mr. Wainwright for kindly naming all the obscure species. I have used his nomenclature in the following list.

Servillia lurida F.—'Between Liskeard and Doublebois, 28.iv. 1904' ('V.C.H.').

Echinomyia fera L.—Locally common. Padstow and St. Merryn Dist. (Dr. C. G. Lamb) ; St. Ives, Carbis Bay, Tintagel, Bodmin Dist., Truro (A.T.).

E. grossa L.—Some years locally common, especially near the coast. Tintagel Dist., Trebarwith and Cawsand (C. W. Bracken); Penwethers (Rollason); Botus Fleming (Rev. T. A. Marshall); Looe (Adams); St. Ives, Carbis Bay, Lelant Towans (A.T.). In this last locality the species occurs every year.

Fabriciella ferox Pz.—St. Merryn Dist. (Dr. C. G. Lamb); Boscastle, and near Tintagel by C. J. Wainwright; and from the same localities by C. W. Bracken (1915, *Entomologist*, **48**: 285); Millock, 17.vii.24 (E. H. Sills).

Micropalpus vulpinus Fln.—W. Cornwall (C. W. Dale, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Looe (Adams); Carbis Bay and the Goonhilly Downs, Lizard Dist. (A.T.).

Ernestia radicum F.—Common on umbels in August and September. Altarnum and Liskeard ('V.C.H.'); St. Merryn Dist. (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, St. Erth, Lamorna Cove, Bodmin, Truro (A.T.).

E. connivens Zett.—Three male *Ernestia* taken by me at St. Ives on 3.viii.27, 3.viii.31 and 12.vii.33 were submitted to Mr. C. J. Wainwright for examination and he returned them as most probably this species (*cf.* 1932, *Trans. Ent. Soc. Lond.*, **80**: 407).

Lypha dubia Fln.—Pentillie, 12.v.93 (Col. J. W. Yerbury, 1919, *Rep. Devons. Ass. Adv. Sci.*, **51**: 236).

Lydina aenea Mg.—Carbis Bay, one specimen, July, 1930 (A.T.).

Winthemia quadripustulata F.—St. Merryn Dist. (Dr. C. G. Lamb).

Carcelia comata Rond.—St. Ives, 1 ♂, 16.vi.32 and Carbis Bay, 1 ♀ in May, and 1 ♂ in July, 1933 (A.T.).

C. gnava Mg.—Loe Pool, Helston, 1 ♀, 23.vi.26 and St. Ives, 1 ♂, 14.viii.30 and 1 ♀, 3.vii.34 (A.T.).

C. bombulans R.-D. (=*lucorum* Mg.).—A few specimens at St. Ives and Carbis Bay (A.T.).

Exorista mitis Mg.—A single female taken by me at St. Ives, 26.viii.26, was identified doubtfully as this species by Mr. C. J. Wainwright (1928, *Trans. Ent. Soc. Lond.*, **76**: 187), but must remain a little uncertain until some males are captured.

E. westermanni Zett.—I have taken several examples of this little-known species at St. Ives, Carbis Bay, St. Erth, Lamorna Cove and Dunmere Woods, Bodmin. It occurs chiefly from the middle of May to the end of the first week of October.

E. (Phryxe) vulgaris Fln.—Common in all districts (A.T.).

E. (P.) nemea Mg.—Equally common with the above.

Pelmatomyia phalaenaria Rond.—This little-known species has occurred in W. Cornwall at St. Ives, Carbis Bay, Lelant, and St. Erth (A.T.); Newquay (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 189).

Epicampocera succincta Mg.—Common. St. Merryn Dist. (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, St. Erth, Tintagel, Loe Pool, Helston, Bodmin Dist., Truro Dist (A.T.).

Paraphorocera senilis Mg.—St. Merryn Dist. (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant Towans, Phillack Towans, Perranuthnoe, Porth Levan, Truro Dist. (A.T.).

Lydella nigripes Fln.—Rather common. St. Ives, Carbis Bay, Lamorna Cove, Tintagel Dist. (A.T.).

L. stabulans Mg.—St. Ives, Carbis Bay, Tintagel (A.T.).

Erycia fatua Mg.—Three males, bred from Cornish *Euphydryas aurinia* Rott., 1920, were sent to Mr. C. J. Wainwright by Mr. A. H. Hamm (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 192). Apparently the only British record.

Compsilura concinnata Mg.— There is a record of a *Tachina concinnata* in 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265, by C. W. Dale, which is most probably this species.

Pales pavida Mg.—Occurs sparingly. Recorded from W. Cornwall by C. W. Dale as *Tachina pumicata* (1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265) which is probably this species. I have taken it at St. Ives, Lelant, and Carbis Bay, with the form *pumicata* Mg., and also at Bodmin.

Meigenia bisignata Mg.—Lelant, 1 ♂, 24.vi.30 (A.T.).

M. mutabilis Fln. (=*floralis* Wainwright, 1928).—Lelant, 1 ♂, 14.viii.28 and Carbis Bay, 1 ♀, 27.vii.31 (A.T.).

Chaetotachina rustica Mg.—St. Merryn, Padstow (Dr. C. G. Lamb). Lelant Towans, 1 ♂, 2.ix.29; Carbis Bay, 1 ♀, 10.ix.31 (A.T.).

Tachina (Microtachina) erucarum Rnd. — St. Merryn (Dr. C. G. Lamb).

T. fasciata Fln.—St. Ives, Lelant Towans, Tintagel (A.T.); N. Cornwall, bred from larvae of *Eriogaster rubi* L. (P. Siviter Smith).

T. larvarum L.—Not uncommon. St. Ives, Carbis Bay, Lelant Towans (A.T.).

Tricholyga sorbillans Wied.—Two ♂♂ and 1 ♀ bred from a larva of *Saturnia pavonia* L. found at Zennor, August, 1924, by Dr. O. W. Richards (1932, *J. Ent. Soc. S. Engl.*, **1** (1): 11).

Perichaeta unicolor Fln.—This species, usually considered uncommon, occurs in some numbers in W. Cornwall in June, and again in larger numbers in August and September. I took a pair *in copula* in Carbis Bay as late as October 31st. St. Ives, Carbis Bay, Gurnard's Head, Kynance Cove, Tintagel and Boscastle (A.T.).

Conia ornata Mg.—St. Ives (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 200); Perranporth, 2 or 3 examples in 1910 (Rollason).

C. capitata De G.—This species was recorded by Mr. C. W. Dale for W. Cornwall (1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265), but as there is much confusion between this species and the previous one the record must be considered doubtful.

Voria ruralis Fln.—Common. St. Ives, Carbis Bay, Helston, Bodmin Dist. (A.T.).

Anachaetopsis ocypterina B. & B.—Boscastle, one specimen, 8.vi.33 (A.T.).

Wagneria latifrons Zett.—Bodmin, 1 ♀, 13.ix.30 (A.T.).

W. nigrans Mg.—Padstow and St. Merryn Dist. (Dr. C. G. Lamb); Phillack Towans, Hayle, 2 specimens, 6.ix.29 (A.T.).

Ptychoneura cylindrica B. & B.—Carbis Bay, 1 ♀, 27.vi.29 (A.T.).

Phytomyptera nitidiventris Rnd.—Recorded as a prey of *Blepharipus leucostomus* L. A single female was taken at Relubbus, 26.vii.25 (1926, *Trans. Ent. Soc. Lond.*, **74**: 324).

Bucentes geniculata De G.—Common and widely distributed. I have taken it as late as 9th November. SCILLY, F. Jenkinson (*teste* Dr. C. G. Lamb).

B. cristata F.—Nearly as common as the above.

Blepharomyia amplicornis Zett.—Carbis Bay 1 ♂, 4.vii.32 (A.T.).

Actia antennalis Rnd.—Pencalenick, Truro Dist., 1 specimen, 5.viii.32 (A.T.).

A. bicolor Mcq.—Carbis Bay, 1 ♀, 23.v.30, another rescued by my wife from *Empis tessellata* F. on 27.v.30. A ♂ in our garden on 27.v.32 and another on the study window 17.vi.34.

A. frontalis Mcq.—Lelant, 1 specimen, 23.vi.28 (A.T.). Carbis Bay, 1 ♀, 3.vii.30; 1 ♀, 29.vi.34; 1 ♂, 15.vii.32 and 1 ♂, 26.vi.34 (A.T.). Bossiney, N. Cornwall, 1 specimen, 12.vi.33 (A.T.).

A. pilipennis Vill. (=*reducta* Vill.).—Common at least in W. Cornwall; often found on house windows as late as October. St. Ives, Carbis Bay, Lelant Towans, Pencalenick (A.T.).

Degeeria collaris Fln.—Boscastle, 1 ♂, 8.vi.33 (A.T.).

Macquartia nitida Zett.—Belongs to a group of closely allied species very difficult to separate. Specimens taken by me at St. Ives, Carbis Bay, Lelant, and Bodmin have been named provisionally *nitida* Zett. by Mr. Wainwright.

M. dispar Fln.—Common. St. Merryn and Padstow (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, Bodmin, Tintagel, Boscastle (A.T.).

M. grisea Fln.—Common. St. Ives, Carbis Bay, Lelant, Porth Navas (A.T.).

Minella chalybeata Mg.—Padstow and St. Merryn Dist. (Dr. C. G. Lamb).

Bithia spreta Mg.—Not uncommon. Padstow and St. Merryn Dist. (Dr. C. G. Lamb); Launceston ('V.C.H.'); Looe (Adams); St. Ives, Carbis Bay, Lelant (A.T.).

Aphria longirostris Mg.—Chapel Porth, St. Agnes, 2 ♂♂, 27.vi.32. The species was not uncommon in the nearly dry bed of a stream flowing down the cliff (A.T.).

Myiobia tibialis v. Ros.—Lelant, 3 specimens in 1930 (A.T.).

M. inanis Fln. (=*longipes* Mg.).—St. Erth, 2 ♀♀, August, 1927 (A.T.). The genus *Myiobia* seems at present to be in some confusion. The above specimens were, however, named for me provisionally by Mr. C. J. Wainwright. At least two species are recorded in the 'V.C.H.,' but in the light of the present unsatisfactory state of the genus these records must be considered unreliable.

Eriothrix rufomaculatus De G.—Common. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265 as *Oliveria lateralis*); Padstow and St. Merryn Dist. (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, St. Erth, Lamorna Cove, St. Hilary, Cadgwith (Lizard), Bodmin (A.T.); Phillack, Marazion and Helston (L. Parmenter).

Ocyptera brassicaria F.—'Col. V. W. Yerbury took a series at the Lizard in 1896, some of which are in the British Museum, and others in the Verrall collection' (C. J. Wain-Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 221).

Phyllomyia volvulus F.—The species seems scarce in Cornwall. The only record occurs in C. W. Dale's list under the name of *Mintho volvulus* (1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265).

Thelaira nigripes F. (=*leucozona* Pnz.).—Common and widely distributed. Padstow and St. Merryn Dist. (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, Truro, Bodmin, Tintagel and Boscastle (A.T.).

Trixa oestroidea R.-D.—Apparently uncommon. A few specimens taken at St. Ives and Carbis Bay (A.T.).

Dexia rustica F.—Padstow and St. Merryn Dist. (Dr. C. G. Lamb); Boscastle (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 224); St. Ives, St. Erth, Lamorna Cove, Lanhydrock (A.T.).

Dexiosoma caninum F.—W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Carbis Bay, Truro, Bodmin Dist. (A.T.).

Dinera grisescens Fln.—St. Merryn Dist. (Dr. C. G. Lamb).

Plesina maculata Fln.—Wadebridge (M.K.F.T.); Carbis Bay, 2 ♀♀, taken on windows in the house, 22.vii.32 and 12.vii.33 (A.T.).

Styloneuria discrepans Pand.—Local, but common where it occurs and widely distributed. Penzance and Gunwalloe (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 226); Padstow (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, St. Erth, Helston, Chapel Porth, Tintagel, Truro (A.T.).

Frauenfeldia rubricosa Mg.—Kynance Cove, 1 ♂, 24.vi.32 (A.T.).

Melanophora roralis L.—Very local. Lizard, Col. J. W. Yerbury (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 227); St. Ives (where it occurred rather commonly); Carbis Bay, 1 ♂, 1928; Lamorna Cove, 1 ♀, 1926 (A.T.).

Phyto melanocephala Mg.—Padstow (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, Tintagel (A.T.).

Rhinophora lepida Mg.—Padstow (Dr. C. G. Lamb); St. Ives, St. Erth, Hayle Towans, Truro and Bodmin Dists. (A.T.).

Genus **Sarcophaga** Mg.—This well-known genus has been in a state of some confusion until quite recently, but Mr. Wainwright's list (*Trans. Ent. Soc. Lond.*, **76**: 228, **80**: 417) gives us the very latest results of a study of the genus, and includes twenty-eight species, of which three are new to the British list. One of these, *S. hirticrus* Pand., was first taken by myself in Cornwall in 1925. Out of the twenty-eight species on the above-mentioned list no less than twenty have been taken in the county, and there are probably more to be discovered. The records in the following list are of males only, as the specific differences of the females are as yet not properly known.

S. agnata Rond.—Carbis Bay, 1 ♂, July, 1929; 2 ♂♂, July, 1931 and 1 ♂, July, 1932. Tintagel, in this district the species occurred rather commonly in June, 1933, on all the headlands (A.T.).

S. aratrix Pand.—Rather common. St. Ives, Carbis Bay, Lelant Towans, Truro and Bodmin Dists., Tintagel (A.T.).

S. carnaria L.—Abundant in all districts. Scilly, Tresco, August, 1878, F. Norgate (1880, *Ent. Mon. Mag.*, **16**: 183).

S. crassimargo Pand.—Rather common. St. Ives, Carbis Bay, Lelant, Tintagel (A.T.).

S. dissimilis Mg.—Carbis Bay, 3 specimens, 9.viii.30, 23.vi.32 and 5.vii.33 (A.T.).

S. filia Rond.—Lelant Towans, June, 1932, and August, 1933; Marazion, 20.vi.32 (A.T.).

S. frenata Pand.—The commonest of the group with red genital segments. St. Ives, Carbis Bay, Lelant Towans, Bodmin Dist., Truro Dist., Porth Navas, Tintagel, Bossiney, and Boscastle (A.T.).

S. haemorrhoa Mg.—Much less common than the above. St. Ives, Carbis Bay, Truro (A.T.).

S. hirticrus Pand.—This species was recently added to the British list as a result of specimens taken by me first at St. Ives in 1925, and afterwards rather commonly at Carbis Bay and Lelant Towans; a pair were taken *in copula* at Sennen Cove in 1926. (See 1931, *Ent. Mon. Mag.*, **67**: 91 and 1932, *Trans Ent. Soc. Lond.*, **80**: 417).

S. incisilobata Pand. (=*striata* Mg.).—Not uncommon, Gurnard's Head, St. Ives, Carbis Bay, Lelant Towans, Porth Navas, St. Mawes, Goonhilly Downs (A.T.).

S. melanura Mg.—Common and widely distributed.

S. nigriventris Mg.—Widely distributed; the commonest of the smaller species. SCILLY, Tresco, 11.iv.04 (Col. J. W. Yerbury, 1904, *Ent. Mon. Mag.*, **40**: 154).

S. offuscata Sch.—Common. St. Ives, Carbis Bay, Lelant, St. Erth, Loe Pool, Helston, Lamorna Cove, St. Michael Penkevil (A.T.).

S. pumila Mg.—A few specimens at St. Ives and Carbis Bay (A.T.).

S. scoparia Pand.—St. Ives, Carbis Bay, Bodmin Dist., Bossiney and Boscastle (A.T.).

S. setipennis Rond.—Padstow (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant and Hayle Towans (A.T.).

S. sinuata Mg.—I took 2 males of this rare species in the 'Rocky Valley,' Bossiney, N. Cornwall, on 10.vi.33 (A.T.).

S. striata F. (=*haematodes* Mg.).—Rather uncommon. Penzance, G. H. Verrall (R. H. Meade, 1876, *Ent. Mon. Mag.*, **12**: 267). A few taken at Carbis Bay and on the Lelant Towans (A.T.). SCILLY (in Jenkinson Collection, Cambridge Univ. Museum, *teste* Dr. C. G. Lamb, 1934).

S. teretirostris Pand.—Rather common. Padstow (Dr. C. G. Lamb); St. Ives, Carbis Bay, Lelant, Chapel Porth (St. Agnes), Tintagel and Bossiney (A.T.).

S. vicina Vill.—Nearly as common as *carnaria*.

Sarcophila latifrons Fln.—Uncommon. Padstow (Dr. C. G. Lamb); St. Ives, Lelant and Phillack Towans (A.T.).

Nyctia halterata Pz.—Apparently local and uncommon. Padstow (Dr. C. G. Lamb); the Rocky Valley, Bossiney, N. Cornwall, 1 example, 10.vi.33 (A.T.).

Morinia nana Mg.—Calenick (Truro Dist.), 1 specimen, 3.vii.32 (A.T.). Probably the *M. melanoptera* of C. W. Dale's list (1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265) may be this species.

Medoria anthracina Mg. (=*digramma* B. & B.).—Lizard, 1 ♂ taken on samphire (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 232).

Brachycoma devia Fln.—Locally common. St. Ives, Carbis Bay, Lelant Towans, Truro Dist., Bossiney and Tintagel (A.T.).

Miltogramma germeri Mg.—Padstow. 'Seen in some numbers by Dr. C. G. Lamb (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 233).

Setulia grisea Mg.—Padstow (Dr. C. G. Lamb).

Metopia leucocephala Rossi.—St. Ives, Carbis Bay, Lelant, St. Erth, Helston (A.T.).

M. campestris Fln.—Dunmere Woods (Bodmin Dist.), 1 ♂, 20.vii.29 (A.T.).

Sphecapata conica Fln.—Padstow (Dr. C. G. Lamb); Lelant Towans, where it is sometimes common near the burrows of Hymenoptera (A.T.).

Pollenia rudis F.—Very common and recorded from all districts.

P. vespillo F.—Locally common. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Bodmin Dist., rather common (A.T.).

P. varia Mg.—See Mr. Wainwright's notes about this newly-introduced species (1932, *Trans. Ent. Soc. Lond.*, **80**: 421-2) which he records from St. Ives. I have specimens taken at St. Ives, Carbis Bay, and on the Lelant Towans, which he considers to be most probably this species.

Phormia coerulea R.-D. (=*groenlandica* Zett.).—Lelant, where it is sometimes common in the estuary (A.T.).

P. sordida Zett. (=*azurea* auct.).—Bodmin Dist., in the Lanhydrock and Dunmere Woods (A.T.).

Lucilia caesar L.—Common in all districts. SCILLY, specimens in the Jenkinson Collection at Cambridge, *teste* Dr. C. G. Lamb.

L. illustris Mg. (=*simulatrix* Pand.).—Nearly as common as *caesar* in all districts.

L. ampullacea Vill. (=*flavipennis* Kramer).—St. Ives and Carbis Bay (A.T.).

L. bufonivora Mon.—In the Lizard Dist., on the Goonhilly Downs, 1 ♂, 7.viii.30, and at Kennack, 1 ♂, 5.ix.33 (A.T.). It is probably not uncommon in the county, as at St. Erth we saw a large toad with its nostrils almost eaten away, though it appeared quite lively otherwise (August, 1927).

L. silvarum Mg.—Lelant Towans, 1 ♀, 23.viii.33, and Truro Dist., 1 ♂, 2.viii.34 (A.T.).

L. richardsi Collin.—I have taken this newly-introduced species rather commonly at Gurnard's Head, St. Ives, Carbis Bay, and on the Lelant Towans (A.T.).

L. sericata Mg.—Rather common. Whitsand Bay, June, 1893 (Col. J. W. Yerbury, 1919, *Rep. Devons. Ass. Adv. Sci.*, **51**: 239); St. Ives, Carbis Bay, Lelant, Sennen Cove, Truro and Bodmin Dists. (A.T.). SCILLY (Jenkinson, see *ante* under *L. caesar*).

Calliphora erythrocephala Mg.—Common everywhere.
C. vomitoria L.—Common everywhere.
Onesia agilis Mg.—Common in all districts.
Melinda coerulea Mg. (=*cognata* auct.).—Locally common. St. Ives, Carbis Bay, Lelant Towans, St. Erth, Hayle Towans, Bodmin, Tintagel (A.T.).
M. anthracina Mg. (=*gentilis* Stein).—The only record, St. Ives, 1 ♂, 25.v.27 (A.T.).
Cinochira atra Zett.—'Mr. J. E. Collin . . . has a male from St. Germans' (C. J. Wainwright, 1928, *Trans. Ent. Soc. Lond.*, **76**: 242).
Allophora hemiptera R.-D.—Several specimens seen and several females captured, 15.vii.29, at Lanhydrock (A.T.). St. Ives, a male taken from my coat on the Knill Moor, 30.vii.31, by my wife (A.T.). Lelant Towans (L. Parmenter).
Parallophora pusilla F.—St. Merryn Dist. (Dr. C. G. Lamb).

Muscidae.

The title Muscidae is used in its broadest sense to include the subfamilies Muscinae, Phaoniinae, Mydaeinae, Anthomyiinae and finally the Coenosiinae. The family is a very large one containing many of our commonest flies; but at present the synonymy is unfortunately somewhat confused, and as new species are being added to the British list every year, the following list, which contains about 180 species, can only be looked upon as provisional. In C. W. Dale's list of 1891, only 36 true Muscids are mentioned; and in the 'Victoria County History' of 1906, about 44. The following species have been added to the British list only quite recently: *Helina parcepilosa* Stein, *Chortophila insignis* Collin, *Pycnoglossa signata* Brischke, and *Heterostylus atomarius* Schnbl.

I am much indebted to Dr. C. G. Lamb, M.A., F.R.E.S., for a list of Diptera taken in the Scilly Isles by Mr. F. Jenkinson about the year 1900, and now in the Cambridge University Museum.

I have employed chiefly the nomenclature used by Messrs. J. E. Collin and C. J. Wainwright in 1934, *J. Soc. Brit. Ent.*, **1** (1): 17-28.

Musca domestica L.—Abundant everywhere in dwellings.
M. corvina F.—Common in all districts.
Cryptolucilia caesarion Mg.—Common. Occurring sometimes as early as February and continuing into November. Recorded as prey of the ground wasp *Mellinus arvensis* L. (1930, *Trans. Ent. Soc. Lond.*, **78**: 122). Scilly (Jenkinson).
C. cornicina F.—Common, but less so than *caesarion*.

Dasyphora cyanella Mg. — Common and widely distributed; occurring both very early and very late. Recorded in January and February as well as November and December.

Pyrellia cyanicolor Zett. (=*serena* Stein).—E. Cornwall, probably Botus Fleming (Rev. T. A. Marshall).

Graphomyia maculata Scop.—Common in all districts.

Myiospila meditabunda F.—Common in all districts.

Mesembrina meridiana L.—Common in most districts. Often seen in November.

Muscina stabulans Fln.—Common. Often found in houses.

M. assimilis Fln.—Locally common. Often found far away from stables and houses. I have taken it as late as November 20th. St. Ives, Carbis Bay, Lelant, St. Erth, Lanhydrock, Perranuthnoe, Boscastle, Kennack (Lizard) (A.T.); 1 ♀, Helston, 2.viii.34 (L. Parmenter).

M. pabulorum Fln.—Common in all districts, especially near houses. Often found in the winter.

Morellia aenescens R.-D.—Locally common in July and August. St. Ives, Carbis Bay, Lelant, St. Erth, Truro Dist., Bodmin Dist., Tintagel (A.T.); Angarrack (Hayle), Helston (L. Parmenter).

M. hortorum Fln.—Common in all districts.

M. simplex Lw.—Rather less common than the previous species.

Stomoxys calcitrans L.—Common in houses, stable yards and wherever there are cattle.

Haematobia stimulans Mg.—Occurs under the same conditions as the preceding.

Pseudomorellia albolineata Fln.—Common. Recorded from all districts.

Polietes lardaria F.—Common. Taken many times in November and December at ivy blossom.

Phaonia palpata Stein (=*trigonalis* Meade *nec* Mg.).—Not uncommon, St. Ives, Carbis Bay, Lelant, St. Erth, Bodmin Dist. (A.T.).

P. fuscata Fln.—The only record, 1 ♂, St. Ives, 2.iv.27 (A.T.).

P. scutellaris Fln. — Common. Several specimens taken in December (A.T.).

P. variegata Mg. (=*populi* Wlk. *nec* Mg.).—Almost commoner than the preceding. Scilly (Jenkinson).

P. pallida F.—Local. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Trebah, Helford River Dist. (H. W. Andrews); Landulph (Rev. J. H. Adams); St. Erth, Loe Pool, Helston, Lanhydrock, Calenick and Bishop's Wood, Truro Dist. (A.T.).

P. goberti Mik.—Uncommon. Carbis Bay, 1 ♂, 21.v.28 (A.T.).

P. rufipalpis Mcq.—Porth Navas, 2 ♂♂, 18.vi.26 (A.T.).

P. perdita Mg.—Locally common. St. Ives, Carbis Bay, Lelant, Trencrom, Kynance Cove (A.T.).

P. basalis Zett.— Locally common. St. Ives, Lanhydrock, Lostwithiel and Bodmin Dist. (A.T.).

P. signata Mg.—Common. St. Ives, Carbis Bay, Lelant, Truro Dist. (A.T.); Helford River (H. W. Andrews). I have taken it as early as February and many times in mid-November. SCILLY (Jenkinson).

P. erratica Fln.—Apparently uncommon. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Lelant Towans, 1 ♂, 26.vi.30 (A.T.).

P. errans Mg.—Females common, males much less so. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); St. Ives, Carbis Bay, Lelant, Kynance Cove (A.T.).

P. serva Mg.—Locally common. Carbis Bay, Lelant, St. Erth (A.T.).

P. incana Wied.—Common. St. Ives, Carbis Bay, Gurnard's Head, St. Erth, Trencrom, Helston, Land's End, Kynance, Bodmin Dist., Tintagel and Bossiney (A.T.).

P. vagans Fln.—Rare. St. Erth, 1 ♀, 27.vi.33 (A.T.).

Lophosceles cristatus Zett. (=*pulcher* Meade).—Local. St. Ives, Carbis Bay, Lamorna Cove, Bodmin Dist. (A.T.). I have taken this species as late as the end of November.

Lasiops semicinerius Wied.—Rather common. St. Ives, Carbis Bay, St. Erth, Bodmin Dist. (A.T.).

Alloeostylus diaphanus Wied.—Carbis Bay, 1 ♀, 10.xi.32 (an unusually late date) (A.T.); Lanhydrock (Bodmin Dist.), 1 ♀, September, 1930 (A.T.).

Drymeia hamata Fln.—Common some years. St. Ives, Carbis Bay, Gurnard's Head, Lelant, Trencrom, Bodmin Dist., Kennack (Lizard) (A.T.).

Pogonomyia decolor Fln.—The females are rather common, but I have never yet taken a male in my district. St. Ives, Carbis Bay, Lelant, Bodmin Dist. (A.T.).

Hydrotaea occulta Mg.—Rather common. St. Ives, Carbis Bay, Lamorna Cove (A.T.).

H. ciliata F.—A few taken at St. Ives and Carbis Bay (A.T.).

H. cyrtoneurina Zett.—Locally common. St. Ives, Carbis Bay, Truro Dist., Lamorna Cove (A.T.). The female seems scarce, but is probably often passed over in mistake for that of *dentipes* Mg.

H. albipuncta Zett.—Common. St. Ives, Carbis Bay, Lelant, Hayle Towans, St. Michael's Penkevil (A.T.). Relubbus, as prey of *Blepharipus leucostomus* L. (1926, *Trans. Ent. Soc. Lond.*, **74**: 324).

H. cinerea R.-D.—Padstow, 4 ♂♂, July, 1901, Dr. C. G. Lamb (P. H. Grimshaw, 1906, *Ent. Mon. Mag.*, **17**: 73).

H. irritans Fln.—Very common in all districts, even as late as the end of November. Recorded as a prey of *Blepharipus leucostomus* L. at Relubbus (1926, *Trans. Ent. Soc. Lond.*, **74**: 324).

H. similis Meade.—Locally common, but chiefly males. St. Ives, Carbis Bay, St. Erth (A.T.).

H. dentipes F.—Very common in all districts even as late as the middle of November.

H. militaris Mg.—Some years locally common; the females swarming in grass. Males much less common. St. Ives, Carbis Bay, St. Erth (A.T.); Helford River Dist. (H. W. Andrews).

H. meteorica L.—Locally common. St. Ives, Carbis Bay, Lelant (A.T.).

Ophyra leucostoma Wied.—Common in all districts.

Fannia hamata Mcq.—An early species appearing in May and not uncommon. St. Ives, Carbis Bay, Lelant, St. Erth, Truro Dist. (A.T.); Helford River Dist. (H. W. Andrews).

F. fuscula Fln.—Sparingly. St. Ives, Carbis Bay, Lelant, Bodmin Dist. (A.T.); Helford River Dist. (H. W. Andrews). SCILLY (Jenkinson).

F. canicularis L.—Abundant in houses and seen every month of the year. SCILLY (Jenkinson).

F. aerea Zett.—Rather common. St. Ives, Carbis Bay, Lelant, St. Erth, Bodmin Dist., Truro Dist. (A.T.).

F. armata Mg.—Rather common. St. Ives, Carbis Bay, St. Erth, Wadebridge (A.T.); Trebah, Helford River Dist. (H. W. Andrews); taken as prey of *Blepharipus leucostomus* L. at Relubbus, 26.vii.25 (1926, *Trans. Ent. Soc. Lond.*, **74**: 324).

F. scalaris F.—Common. W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); St. Ives, Carbis Bay, Helston (A.T.).

F. monilis Hal.—Uncommon. Carbis Bay, 1 ♂, 18.ix.28; 1 ♂, 12.v.30; 1 ♂, 2.viii.33 (A.T.).

F. manicata Mg.—Rather common. I have taken it as late as November. St. Ives, Carbis Bay, Lelant (A.T.); taken at Relubbus, 26.vii.25, as prey of *Blepharipus leucostomus* L. (1926, *Trans. Ent. Soc. Lond.*, **74**: 324).

F. incisurata Zett.—Common. Often seen flying under trees even in November. St. Ives, Carbis Bay, Coverack (Lizard) (A.T.).

F. sociella Zett.—Locally common. Sometimes taken in November. St. Ives, Carbis Bay, Lelant (A.T.).

F. kowarzi Verr.—The only record is the finding of a female of this species in a burrow of *Blepharipus leucostomus* L. at Relubbus, 26.vii.25 (1926, *Trans. Ent. Soc. Lond.*, **74**: 324).

F. polychaeta Stein.—Moderately common. St. Ives, Carbis Bay, Truro Dist., Helston, Porth Navas (A.T.); taken as prey of *Blepharipus leucostomus* L. at Relubbus, 26.v.25 (1926, *Trans. Ent. Soc. Lond.*, **74**:324).

F. serena Fln.—One of the commonest species of the genus and recorded from all districts. SCILLY (Jenkinson).

F. similis Stein.—Uncommon. 1 ♂, 2 ♀♀, Carbis Bay, 9.vi.32 (A.T.); also recorded as prey of *Blepharipus leucostomus* L., 26.vii.25, at Relubbus (1926, *Trans. Ent. Soc. Lond.*, **74**: 324).

F. coracina Lw.—Carbis Bay, Lelant, St. Erth (A.T.). Appears to be uncommon.

Fannia mutica Zett.—Recorded by C. W. Dale for W. Cornwall (1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); St. Ives, Carbis Bay, Lelant, St. Erth, Lanhydrock, Bodmin Dist. (A.T.).

Coelomyia spathulata Zett.—Locally common from the end of April, and through May. St. Ives, Carbis Bay, Lelant (A.T.).

Azelia cilipes Hal.—Common from May to the end of November and sometimes seen in midwinter (A.T.).

A. macquarti Staeg.—Common; often seen in the winter. St. Ives, Carbis Bay, Truro Dist., Coverack, Lizard (A.T.); Helford River Dist. (H. W. Andrews).

A. gibbera Mg.—Uncommon. St. Ives, 1 ♀, 3.vi.30 (A.T.).

A. zetterstedti Rond.—Common. St. Ives, Carbis Bay, Lelant, St. Erth, Lamorna Cove (A.T.).

A. aterrima Mg.—Uncommon. Carbis Bay, 1 ♂, 25.v.32 and 1 ♂, 11.v.33 (A.T.).

A. triquetra Wied.—Occurs in all districts.

Hebecnema fumosa Mg.—Uncommon. St. Ives, 1 ♂, 20.vi.25 and St. Erth, 1 ♂, 9.viii.27 (A.T.). SCILLY (Jenkinson).

H. umbratica Mg.—Common in all districts (A.T.).

H. nigricolor Fln.—Uncommon. St. Ives, 1 ♀, 1.vii.29 (A.T.). Carbis Bay, 1 ♀, 4.x.29; 1 ♀, 12.x.29; and 1 ♀, 9.xi.32 (a very late date) (A.T.).

H. vespertina Fln.—Common in all districts. SCILLY (Jenkinson).

Mydaea pagana F.—W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265); Trebah, Helford River Dist., 1928 (H. W. Andrews); St. Ives, 1 ♂, 25.v.27 (A.T.).

M. tincta Zett.—St. Ives, 1 ♀, 30.vi.33; Carbis Bay, 2 ♂♂, 7.vii.28 (A.T.).

M. urbana Mg.—Common in all districts.

M. ancilla Mg.—Rare and local. St. Ives, 3 ♀♀ in 1926-27; 2 ♂♂ May, 1930 (A.T.). Carbis Bay, 1 ♀, 24. ix. 29; St. Erth, 1 ♂, 12.v.31 (A.T.).

Helina atripes Meade.—Local. St. Ives, Carbis Bay, Lelant, Bodmin Dist., Coverack (Lizard Dist.) (A.T.).

H. setiventris Ringdl. (=*duplaris* Stein *nec* Zett.).—Two Helinas, a ♂ at St. Ives, 9.vii.25, and a ♀ taken in the Dunmere Woods, Bodmin, 12.vii.29, were identified for me by Mr. J. E. Collin as this species (A.T.).

H. duplicata Mg.—There is much confusion between this species and *communis* R.-D. I have, however, some specimens taken chiefly at Carbis Bay which have been determined for me by Mr. Collin as this species. SCILLY, recorded both by Mr. Jenkinson and Col. J. W. Yerbury (1904, *Ent. Mon. Mag.*, **40**: 155).

H. communis R.-D.—Very common in all districts. Recorded from Padstow by Dr. C. G. Lamb as the prey of the ground wasp *Mellinus arvensis* L. (1930, *Trans. Ent. Soc. Lond.*, **78**: 122).

H. lucorum Fln.—Common in all districts from February to November. SCILLY (Jenkinson).

H. obscurata Mg.—Uncommon. St. Erth, a ♂ and ♀ swept in a marshy place, 18.vii.27 (A.T.).

H. quadrimaculata Fln.—Uncommon. Carbis Bay, 1 ♀, 2.vi.32; Goonhilly Downs, 1 ♀, 7.ix.32; St. Ives, 1 ♀, 11.ix.33; Truro Dist., 1 ♀, 2.viii.34 (A.T.). I have not yet taken the male.

H. maculipennis Zett.—Uncommon. St. Ives, 1 ♂, 23.ix.26. Carbis Bay, 1 ♂, 29.x.27; 3 ♂♂, 9 and 14.v.32; 2 ♂♂, 17.v.33; 1 ♂, 14.v.34 (A.T.).

H. latitarsis Ringdl. (=*nivalis* Stein, *dispar* Meade *nec* F.).—Dunmere Woods (Bodmin Dist.), 1 ♂, 12.vii.29 (A.T.).

H. lasiophthalma Mcq.—Local. Carbis Bay, Lelant, Kennack (Lizard Dist.) (A.T.).

H. impuncta Fln.—Common in all districts. I took a remarkable specimen (22.v.28) with the abdomen covered with strong bristles, but in other respects normal (A.T.).

H. anceps Zett.—Very local. Carbis Bay, Hayle Towans (A.T.); Trebah (Helford River Dist.), 1928 (H. W. Andrews).

H. quadrum F.—St. Ives, Carbis Bay, Lelant, Hayle Towans (A.T.).

H. parcepilosa Stein.—Upton Towans (Hayle), 1 ♂, 25.ix.28; Carbis Bay, 1 ♀, 24.viii.30 (A.T.).

H. depuncta Mg.—Local. Bodmin, several in July, 1929, and September, 1930 (A.T.).

H. consimilis Fln.—Several at St. Ives and Carbis Bay, two being taken from windows in the house (A.T.).

H. uliginosa Fln.—The only record; Carbis Bay, a ♂ taken from a window of the house, 18.viii.30 (M.K.F.T.).

Melanochelia (Calliophrys) riparia Fln.—Local. Lelant Towans, 18.v.27 (A.T.).

Limnophora (**Pseudolimnophora**) **triangula** Fln.—Rather common. St. Ives, Carbis Bay, St. Erth, Bossiney and Tintagel, Lanhydrock, Bodmin, Calenick and Pencalenick (Truro Dist.) (A.T.).

L. maculosa Mg.—Common. St. Ives, Carbis Bay, Lelant, St. Erth, Pencalenick (Truro), Tintagel (A.T.). Several times taken in November.

L. exsurda Stein (=*setinerva* Schnbl.).—Common in W. Cornwall. Found on wet rocks and walls usually in company with the Dolichopodid *Liancalus virens* L. even in the winter months (November to February); St. Ives, Carbis Bay, Hayle Towans (A.T.); Padstow (Dr. C. G. Lamb); Port Wrinkle and Lelant, August and September, Col. J. W. Yerbury (1921, *Ent. Mon. Mag.*, **57**: 246); Trebah, Helford River Dist., in 1928 (H. W. Andrews).

L. (**Villeneuvia**) **aestuum** Vill.—Lelant Towans, a few in June, July and August (A.T.).

Spilogona (**Cymnodia**) **humilis** Zett.—Rather common at St. Ives and Carbis Bay. Taken also at Idless, Truro Dist. (A.T.).

Lispa tentaculata De G.—St. Ives and St. Erth (A.T.).

L. consanguinea Lw.—Padstow Dist., September, 1904 (Dr. C. G. Lamb) (1913, *Ent. Mon. Mag.*, **49**: 132).

Eustalomyia histrio Zett.—Trabah, Helford River Dist., 1928 (H. W. Andrews).

Hydrophoria ruralis Mg. (=*anthomyiea* Rond.).—Rather common. St. Ives, St. Erth, Pencalenick (Truro Dist.), Boscastle (A.T.).

H. conica Wied.—It is remarkable that this common fly should apparently be so local in the county. My only record is the Rocky Valley, Tintagel Dist., 1 ♂, 10.vi.33 (A.T.).

Acroptena villosa Ringdl.—Rare. Loe Pool, Helston, a ♂ and ♀, 12.vi.26 (A.T.).

Pegoplata virginea Mg.—Trebah, Helford River, 1928 (H. W. Andrews); Carbis Bay, 2 ♂♂, June, 1931 (A.T.).

Pegomyza praepotens Wied.—Uncommon. St. Ives, Carbis Bay, Lelant Towans (A.T.). This species seems to appear rather late, for I took a ♀ at Carbis Bay on November 4th, 1930.

Pegomyia winthemi Mg. — Uncommon. Lanhydrock, Bodmin Dist., one on 27.vii.29 (A.T.).

P. ulmaria Rond.—St. Ives, 1 ♀, 25.v.25; Carbis Bay, 2 ♂♂, 20.v.32 and 13.vi.34; Lelant Towans, 1 ♀, 31.vii.30 (A.T.).

P. bicolor Wied.—Very common in all districts (A.T.). Scilly (Jenkinson).

P. haemorrhoa Zett.—All my records are from St. Ives and Carbis Bay where the males are common, but the females much less so.

P. albimargo Pand.—St. Ives, 3 or 4 males; Carbis Bay, both males and females in April and May, 1933 (A.T.). Scilly (Jenkinson).

P. hyoscyami Panz.—Rather common, St. Ives and Carbis Bay. The var. *betae* Curtis has been reported at times as severely attacking mangolds at Newquay and St. Agnes in 1902, and in other parts of Cornwall also (*Seale-Hayne Agric. Coll. Rep.*, 1924-28).

P. setaria Mg.—Very local. Carbis Bay and Lelant, 3 ♂♂ and 2 ♀♀, 1930-32 (A.T.).

P. nigritarsis Zett.—Common in all districts.

Hylemyia coarctata Fln.—Lelant Towans, a few examples chiefly females in 1927 (A.T.).

H. strigosa F.—Very common in all districts even in the winter months (A.T.).

H. variata Fln.—Common in all districts; several females with pale hind tibiae (A.T.).

Hylemyza lasciva Zett.—Local. St. Ives, St. Erth, Lanhydrock (Bodmin Dist.), Pencalenick (Truro Dist.) (A.T.); Trebah, Helford River Dist., 1928 (H. W. Andrews).

Chortophila insignis Collin.—During 1931 and 1933 I took 9 specimens of a *Chortophila* at Carbis Bay which Mr. Collin identified as belonging to a species lately named by him *insignis* (A.T.).

C. (Delia) pilipyga Vill.—Of this species, which was introduced to the British list in 1918, I have taken 3 or 4 specimens on the Lelant Towans in 1927 and 1930; also at Truro and Carbis Bay in 1934 (A.T.).

C. (D.) criniventris Zett.—Occurs sparingly. St. Ives, Carbis Bay, Bodmin, Truro (A.T.).

C. (D.) brassicae Bouché.—Common. Reported some years as causing widely-spread damage to cabbages.

C. (D.) carduiformis Schnbl.—The males of this species are rather common at St. Ives and Carbis Bay; I took one also on Trencrom Hill. The females seem scarce (A.T.).

C. (D.) intersecta Mg. (=*neglecta* Meade).—Common at St. Ives, Carbis Bay and Lelant, occurring from January to November.

C. (D.) varicolor Mg.—Apparently uncommon. I have only taken 2 ♀♀ at Carbis Bay.

C. (D.) trichodactyla Rond.—Common. St. Ives, Carbis Bay, Lelant, St. Erth, Bodmin, Lizard (A.T.); recorded as prey of *Blepharipus leucostomus* L. at Relubbus, 26.vii.25 (1926, *Trans. Ent. Soc. Lond.*, **74**: 324). Scilly (Jenkinson).

C. (D.) cilicrura Rond.—Common. St. Ives, Carbis Bay, Lelant, Helston, Porth Navas, Truro Dist., Coverack (Lizard Dist.), Lamorna Cove (A.T.); Trebah (Helford River Dist.) (H. W. Andrews). Scilly (Jenkinson).

C. (D.) exigua Meade.—Several specimens taken by me at Carbis Bay, 1929-33.

C. (D.) antiqua Mg.—St. Ives, 1 ♀, May, 1928 (A.T.). SCILLY, taken on St. Marys, 10.iv.04, and apparently common (Col. J. W. Yerbury, 1906, *Ent. Mon. Mag.*, **40**: 155).

C. (Thrixina) longula Fln.—Lelant Towans, 1 ♀, 27.v.30 (A.T.).

C. (T.) florilega Meade.—A few specimens at Carbis Bay (A.T.).

Pegohylemyia infirma Schnbl.—1 ♂, Bossiney (Tintagel), 10.vi.33 (A.T.).

P. brunneilinea Zett. (=*seticrura* Rond.).—Rather common. St. Ives, Carbis Bay, Idless (Truro Dist.), Porth Navas, Bodmin Dist., Lamorna Cove (A.T.).

P. seneciella Meade.—St. Ives, 1 ♂, 5.vi.26 (A.T.).

P. discreta Mg.—Common. St. Ives, Carbis Bay, St. Erth, Truro Dist., Helston, Gurnard's Head, Kennack (Lizard) (A.T.).

P. fugax Mg.—Common. A fresh male was taken on January 1st, 1932. SCILLY (Jenkinson).

Melinia pullula Zett.—Common. St. Ives, Carbis Bay, Lelant, St. Erth, Goonhilly Downs, Kynance Cove, Coverack and Kennack in Lizard Dist., Marazion (A.T.).

Pycnoglossa flavipennis Fln.—Common amongst bracken. St. Ives, Carbis Bay, St. Erth, Bodmin Dist., Trencrom (A.T.).

P. cinerosa Zett.—Not uncommon with the above at St. Ives and Carbis Bay (A.T.).

P. signata Brischke.—Carbis Bay, 4 ♂♂ and 4 ♀♀, April and May, 1933. They occurred amongst bracken in the garden with the other two species of the genus. I have also taken one or two specimens from the house windows.

Phorbia grisea Ringdl.—St. Ives and Carbis Bay; a few specimens (A.T.).

P. genitalis Schnbl. (=*sepia* auct.).—A few taken at St. Ives, Carbis Bay and St. Erth (A.T.).

Heterostylus atomarius Schnbl.—This little-known species first occurred to me in numbers on the Lelant Towans in May, 1928; they were all found on flowers of *Hieracium pilosella* L. and have regularly appeared in that locality ever since. Later, in 1931, I found it at Carbis Bay on the same flowers.

Paregle cinerella Fln.—Not uncommon. St. Ives, Carbis Bay, Gurnard's Head, Lelant, St. Erth, Goonhilly Downs (A.T.). Trebah in Helford River Dist., 1928 (H. W. Andrews).

P. radicum L.—Common in all districts.

Nupedia aestiva Mg. (=*sulciventris* Zett.).—Common in all districts.

N. dissecta Mg. (=*ignota* Rond.).—A common species in all districts. I took a curious intersexual form on 21.iv.30. SCILLY (Jenkinson).

Egle muscaria F.—SCILLY (Jenkinson).

E. parva R.-D.—SCILLY (Jenkinson).

Opsolasia ctenocnema Kowarz.—St. Ives, Carbis Bay, Lelant, Truro Dist., St. Erth (A.T.).

O. roederi Kowarz.—St. Ives, Carbis Bay, St. Erth (A.T.).

O. adelpha Kowarz (=*meadii* Kowarz).—A few taken in St. Ives and Carbis Bay. It occurred rather commonly in Carbis Bay during November, 1933, even as late as the 20th (A.T.). SCILLY (Jenkinson).

Hammomyia grisea Fln.—Local. St. Ives and Carbis Bay, where it is sometimes common near the burrows of Hymenoptera, especially those of *Panurgus ursinus* Gmel. The female seems very much scarcer than the male.

H. albiseta v. Roser (=*albescens* Zett.).—There is an old record in 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265, of a *Hylemyia albescens* taken by C. W. Dale in W. Cornwall which is probably the above species.

Hylephila buccata Fln.—Lelant, 1 ♂, 14.v.30 (A.T.).

Anthomyia pluvialis L.—Common in all districts.

Mycophaga fungorum De G.—Occurs sparingly in Carbis Bay and St. Ives (A.T.). SCILLY (Jenkinson).

Fucellia fucorum Fln.—W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265).

F. maritima Hal.—Common on the shore everywhere. SCILLY, St. Marys, 1904 (Jenkinson); also by Col. J. W. Yerbury (1904, *Ent. Mon. Mag.*, **40**: 154).

Chirosia albitarsis Zett.—A few specimens taken at St. Ives and Carbis Bay (A.T.).

C. parvicornis Zett.—Has occurred rather commonly at St. Ives and Carbis Bay (A.T.).

Lispocephala erythrocera R.-D.—St. Erth, 10.vii.26 and 13.ix.28 (A.T.).

Dexiopsis lacteipennis Zett. — Several at Carbis Bay (A.T.). SCILLY (F. Jenkinson).

Limnospila albifrons Zett.—Sheviock, 7.ix.12 (Col. J. W. Yerbury, 1919, *Rep. Devons. Ass. Adv. Sci.*, **51**: 242).

Allognota agromyzina Fln.—A few at St. Ives and St. Erth (A.T.).

Spanochaeta dorsalis v. Roser.—Uncommon. St. Erth, 2 specimens, 9.viii.27 (A.T.).

Hoplogaster mollicula Fln.—Recorded from all districts (A.T.).

Coenosia means Mg.—W. Cornwall (C. W. Dale, 1891, *Trans. Penzance Nat. Hist. Soc.*, N.S., **3**: 265).

C. geniculata Fln. — Lelant Towans (common), Goonhilly Downs, the Lizard Dist. (A.T.).

C. tigrina F.—Common in all districts. SCILLY (F. Jenkinson).

C. humilis Mg.—A few at St. Erth (A.T.).

C. tricolor Zett.—Common. Port Wrickle, 5.ix.12 (Col. J. W. Yerbury, 1919, *Rep. Devons. Ass. Adv. Sci.*, **51**: 242); Carbis Bay, Lelant Towans, Bodmin Dist. (A.T.).

C. pedella Fln. (=*decipiens* Mg.).—Rather common. Carbis Bay, Lelant Towans, Goonhilly Downs in the Lizard Dist. (A.T.).

C. sexnotata Mg.—Trebah, Helford River Dist., 1928 (H. W. Andrews).

C. lineatipes Zett. — Sheviock, 3.ix.12 (Col. J. W. Yerbury, *Rep. Devons. Ass. Adv. Sci.*, **51**: 242).

Schoenomyza litorella Fln.—Rather common. St. Ives, Carbis Bay, Lelant, St. Erth's, Land's End, the Truro Dist., Coverack in the Lizard Dist. (A.T.). SCILLY, St. Marys, 10.iv.04 (Col. J. W. Yerbury, 1904, *Ent. Mon. Mag.*, **40**: 155).

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